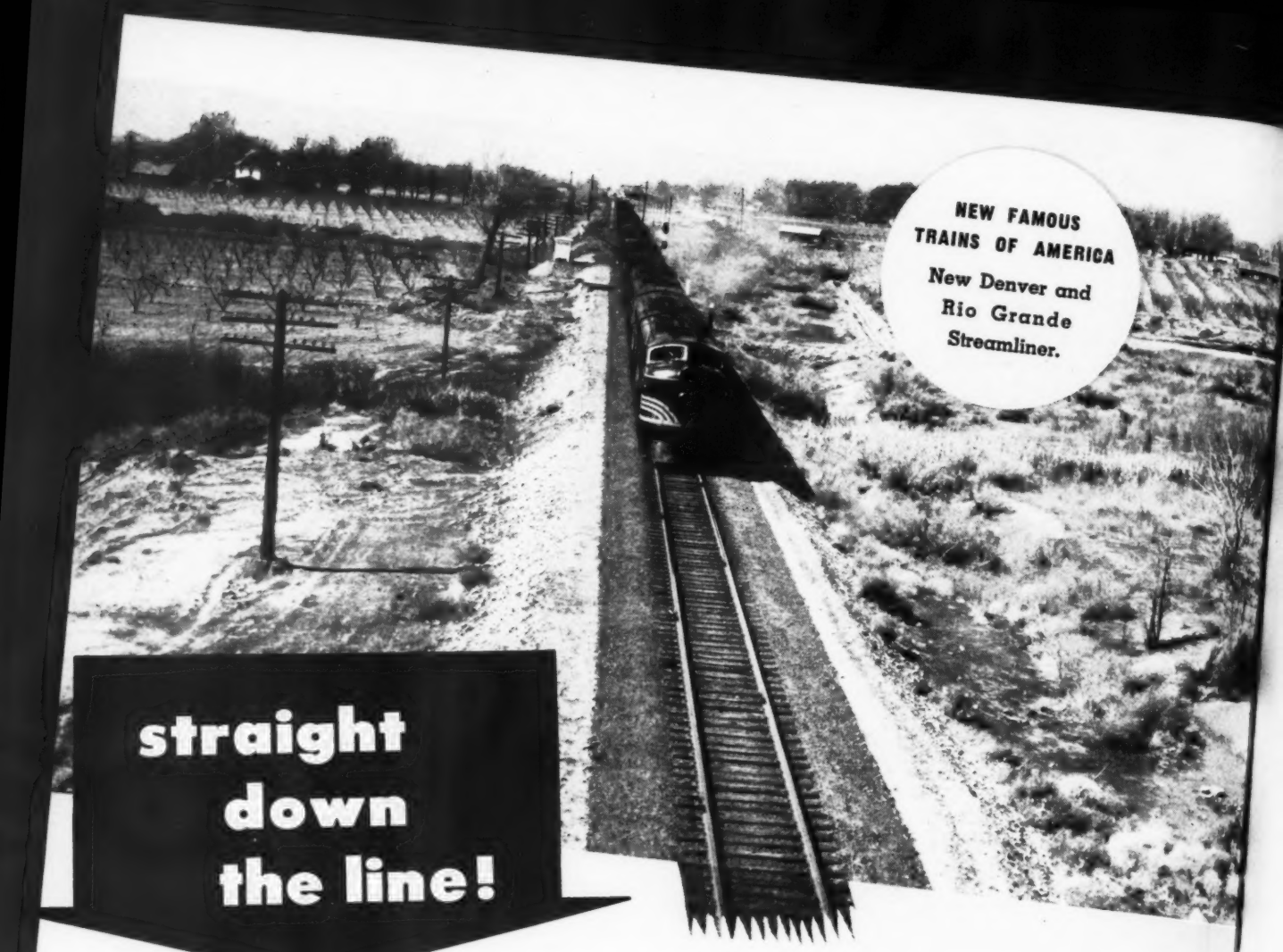
MAY, 1946

Railway Engineering and Maintenance



straight down the line!

New D. and R. G. W. Streamliners roll smoothly along the well maintained right-of-way. Good roadbed, well gauged tracks, correctly maintained joints are factors that contribute to ultimate economy in costs. But even smooth rolling traffic and other factors set up stresses that tend to loosen and reduce the tension in rail joint bolts.

A safety factor which many maintenance-of-way engineers depend on for rail joint security and to keep bolts TIGHTER LONGER under all conditions is Reliance Hy-Pressure Hy-Crome Spring Washers. Sufficient reactive pressure inherent in every Reliance Hy-Pressure Hy-Crome Spring Washer compensates for bolt loosening as a result of wear. Specify Reliance Hy-Pressure Hy-Crome Spring Washers; have troublefree joint bolts on your railroad; keep your rolling stock going straight down the line.

Write TODAY for illustrated folder on Reliance Hy-Pressure Hy-Crome Spring Washers for track application.

EATON
EATON MANUFACTURING COMPANY

Edgemark of Quality

OFFICES AND PLANT MASSILLON, OHIO

Reliance Division

Turntables are given long-term protection from corrosion by applications of NO-OX-ID.

NO-OX-ID prevents corrosion and water contamination in wayside water tanks. Applied inside and out.

Signal bridges and overhead cranes need the positive lasting protection from rust which NO-OX-ID gives.

"NO-OX-ID Waterproofs 'em They can't rust"

NO-OX-ID lubricates rail joints as well as protecting them against rust and "freezing." Easily applied.

Once a steel structure is coated with NO-OX-ID, railroad maintenance men are confident that it will stay rust-free.

The original rust preventive, NO-OX-ID, has served railroads for over a quarter century, keeping structures and equipment safe from the attacks of rust.

The penetrating, chemically compounded coating forms a perfect bond with the metal to mechanically ward off moisture, vapors, brine drippings, and other corrosive elements. The chemical inhibitors immediately stop any corrosion that may be present when the coating is applied, and prevent further corrosive action.

Users of NO-OX-ID find the labor costs for reconditioning structures substantially cut as the coating can be applied directly over rusted surfaces without extensive precleaning.

NO-OX-ID is available in many consistencies. Complete details will be sent upon request.

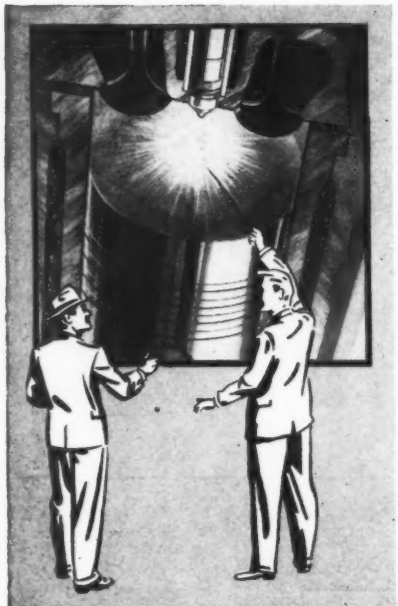
NO-OX-ID IRON RUST REG. TRADEMARK AUG. 27, 1918

The ORIGINAL RUST PREVENTIVE

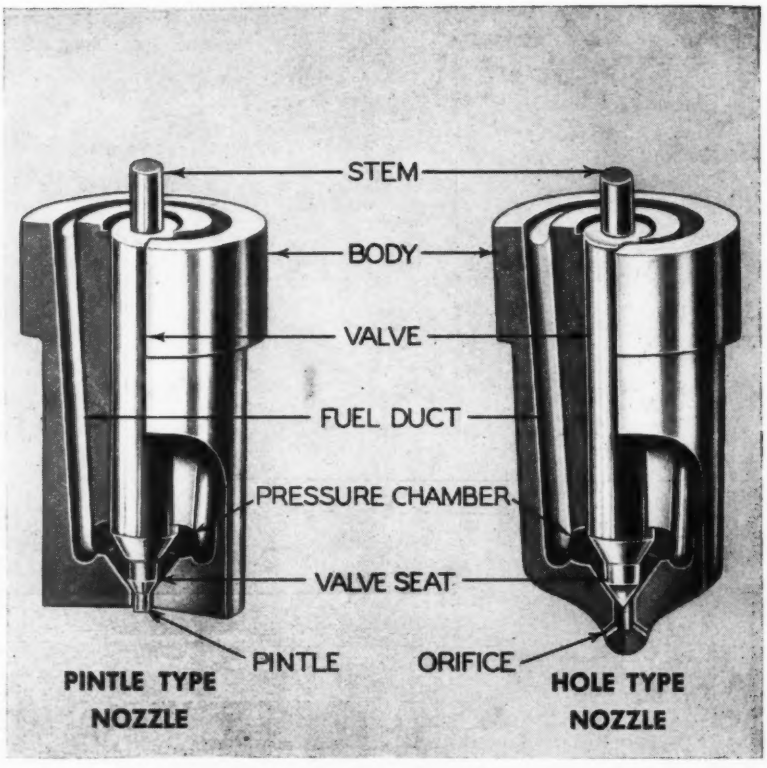
Dearborn Chemical Company
Dept. U, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933 at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., post office. Address communications to 105 W. Adams St., Chicago 3, Ill.

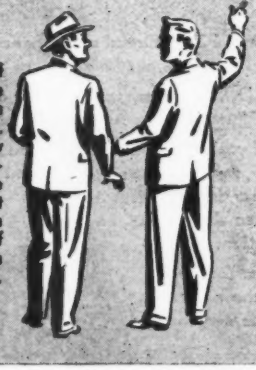
GOOD FUEL INJECTION
Requires a Tailored Spray

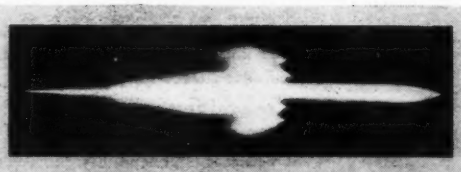


THE MAIN FUNCTION of an injection system is to deliver fuel to the engine cylinders in such a manner that it will burn efficiently. That's why the injection nozzle is so important. It must produce a spray that meets exactly the combustion-chamber requirements.



Tailoring is the art of producing the precise spray characteristic which the engine likes best. Tailoring know-how comes from long experience in correlating the selection of every part of the injection system for the single purpose of providing the engine with the ideal spray pattern.

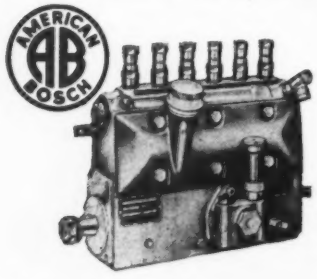




THE CORRECT PATTERN PAYS ITS WAY. American Bosch Injection Equipment provides tailored fuel sprays to fit your Diesel's combustion chamber. That means fuel economy, power to suit the task at hand, and satisfactory performance under all operating conditions.

WRITE FOR A COMPLETE DIRECTORY OF AMERICAN BOSCH AUTHORIZED SERVICE STATIONS.

AMERICAN BOSCH CORPORATION, SPRINGFIELD 7, MASS.



AMERICAN BOSCH
Diesel Fuel Injection

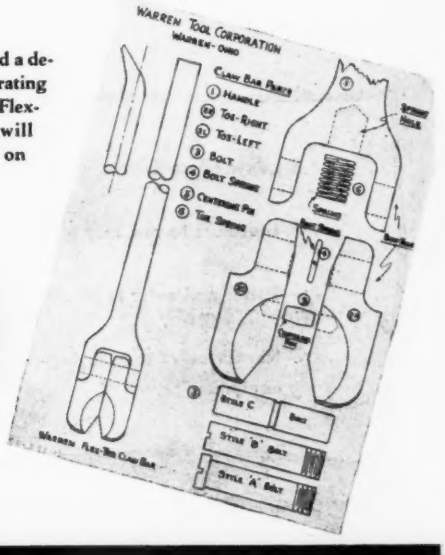
NO BAR WILL PULL 'EM LIKE A Flex-Toe Claw Bar

All spikes come out EASILY . . . though headless or brine eaten. Just the bar for drift bolts and boat spikes. One man only—no blocking—no dangerous spike maul driving.

Flex-Toe Claw Bars are safer—this is now an accepted fact. Also one man can pull more spikes than with any other bar. Besides *all* spikes come out when a man has a Flex-Toe.

If you want a time-saving tool that pulls more and a wider variety of spikes . . . if you want to reduce claw bar expense . . . let us send you literature and prices.

We have now prepared a detailed drawing illustrating repair parts for the Flex-Toe Claw Bar. We will be glad to furnish it on request.



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GENERAL SALES OFFICES: 105 WEST ADAMS STREET, CHICAGO 3, ILLINOIS · PLANT: WARREN, OHIO

Now's the time to Spray your weeds away!

2-4 Dow Weed Killer

Kills weeds easily...completely...chemically

2-4 Dow offers these advantages

- √ **Harmless to ordinary grasses**
- √ **Easier and safer to handle**
- √ **Noncorrosive to spraying equipment**

SAVE MONEY ON MAINTENANCE—Right now, maintenance departments and individuals responsible for weed control everywhere are showing real interest in 2-4 Dow Weed Killer, the new low cost *spray* treatment for obnoxious plant growth.

2-4 Dow Weed Killer eliminates the troublesome job of hand digging, cutting and hoeing. Spray the weed *tops*—kill *roots* and all! Does not harm common grasses when used as directed.

Use 2-4 Dow Weed Killer wherever weeds must go so grass can grow—along roads and streets, in vacant lots, along telephone and power and railroad lines—on lawns, parks, playgrounds, golf courses, cemeteries and airfields. Available in powder or liquid form—packed in convenient sizes for every need.

See Your Dealer or Write Direct!

And ask about other selective weed killers for specific purposes, soon to be announced.

AGRICULTURAL CHEMICAL DIVISION

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
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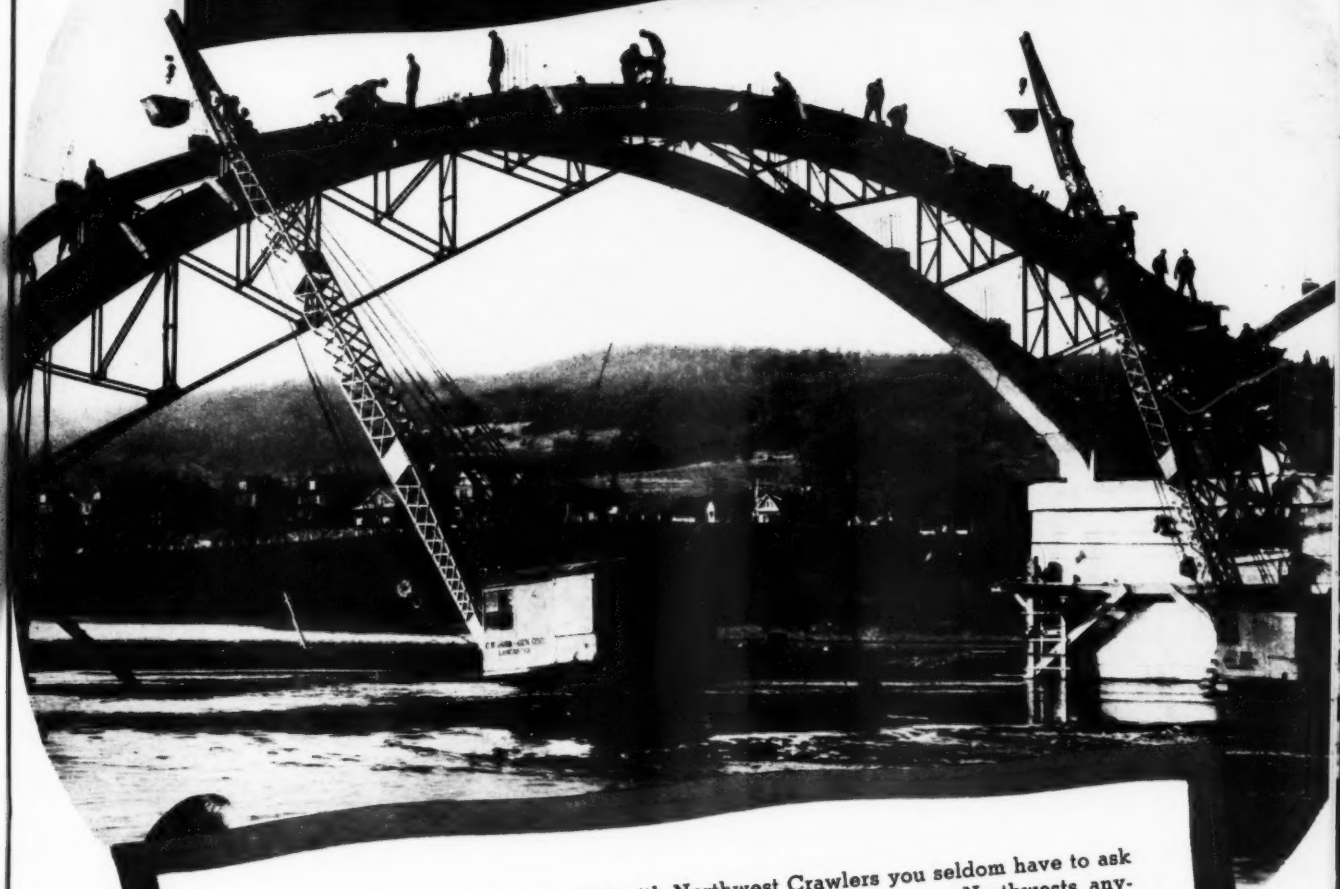
DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

. . . and you can't do this with a track crane!



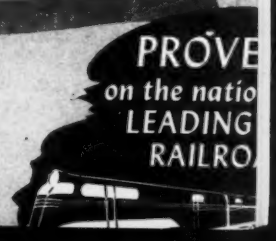
WHEN your division is equipped with Northwest Crawlers you seldom have to ask the question, "How do I do it?" You know you can put your Northwests anywhere you have a lifting or excavating problem, either *on* or *off* the line.

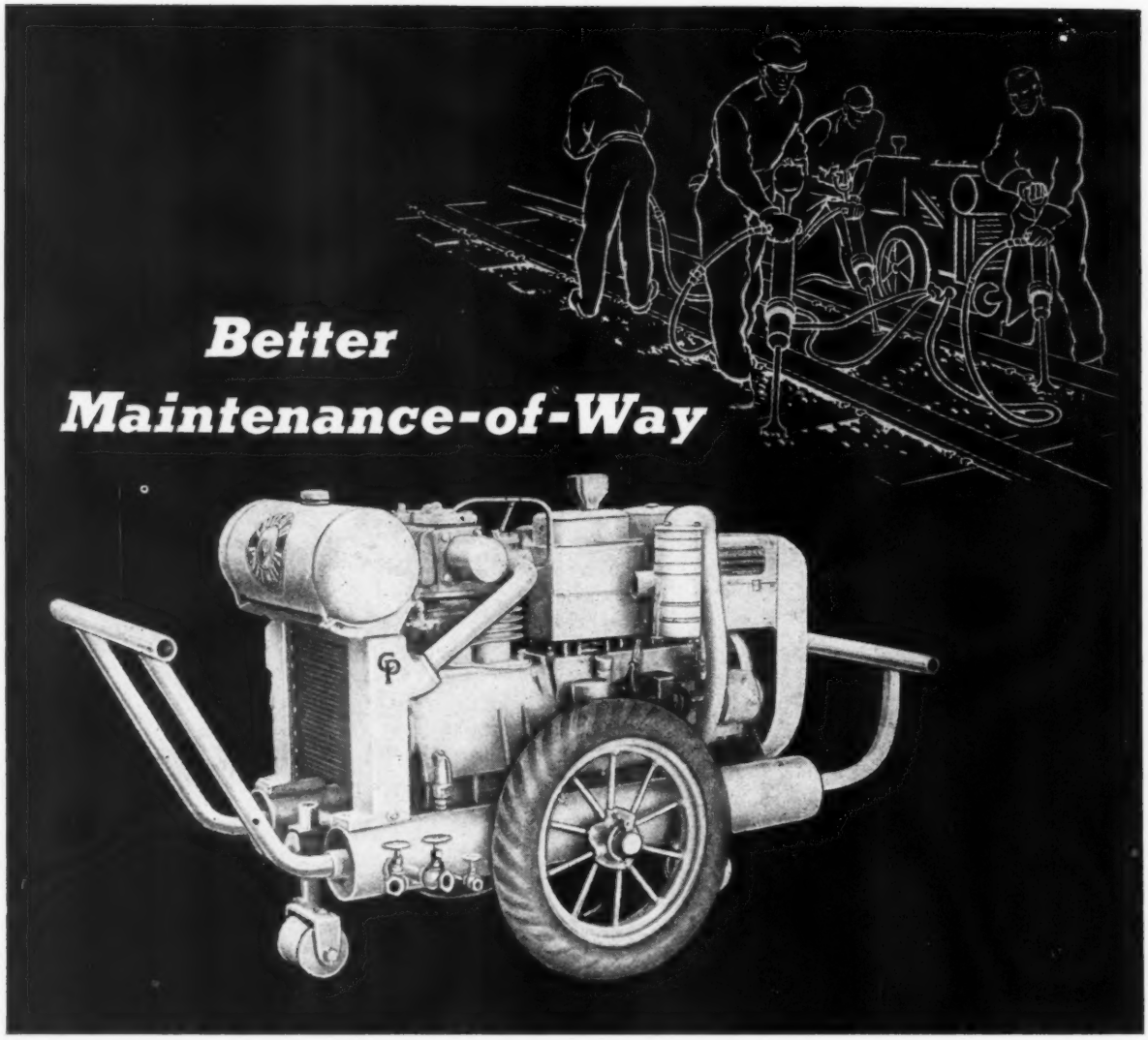
The Northwest Crawler with Northwest steering (positive traction on both crawlers while turning as well as when going straight ahead on larger machines) takes the Northwest where other machines have difficulty. Those bridge jobs involving stream work, drainage jobs in bad going, bank trimming involving grades or difficult maneuvering are every day jobs for Northwests.

Your Northwest goes anywhere. It loads and unloads itself on a standard flat car under its own power without dismantling or it can be transported by trailer to the working point on the line. On the job it leaves the line clear and when necessary it can be converted to a shovel, crane or dragline either in the shop or field by simply changing booms. It is an *all-round* railroad machine.

NORTHWEST ENGINEERING COMPANY
1713 Steger Bldg. • 28 E. Jackson Blvd. • Chicago 4, Ill.

NORTHWEST





CP "PATROL" TAMPER COMPRESSOR

DESIGNED especially for spot tamping, track or bridge repair work. Having an actual capacity of 60 c.f.m. at 100 pounds pressure it operates four CP-3D Tie Tampers or two CP-116 or CP-117 Cut Spike Drivers, or any combination of tools of equal rating. No cooling water required – both compressor and engine are air-cooled. The engine has a power reserve of 50%, therefore is suitable for high altitude or tropical operation without overloading. Easily transported. Easily handled – front and rear retractable dollies provide tight-spot, single-rail handling 'on track' and 4-point support 'off track.' Write for S. P. 2022.

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PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
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CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

Airco railroad technical men have spent years on the lines of American railroads helping to find faster, better, more economical methods of performing maintenance-of-way operations with the oxyacetylene flame and arc welding.

They've carried on constant research in Airco laboratories to develop new processes and new products promoting further efficiency of maintenance-of-way welding operations.

The results of this experience are all combined in this new 32 page booklet "Efficient Maintenance-of-Way Operations with the Oxyacetylene Flame and Arc Welding." It tells—and shows with scores of pictures—how these versatile tools can be employed to do many maintenance-of-way jobs in less time, at less cost and with less effort.

It's a book you'll enjoy reading and want to keep handy for reference. Mail the coupon for your copy today. Write: Air Reduction, 60 E. 42nd St., New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, Houston 1, Texas.

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Send a copy of "Efficient Maintenance-of-Way Operations with the Oxyacetylene Flame and Arc Welding" to

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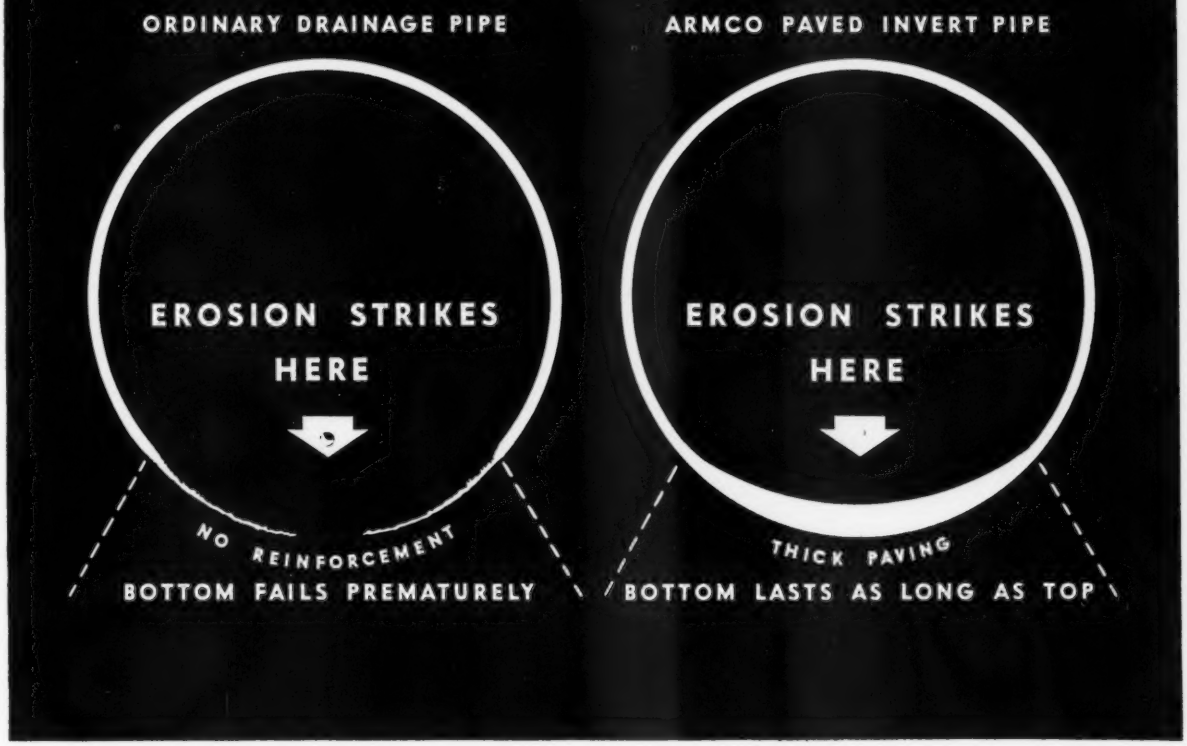
Costs Come Down Under the Airco Plan

HOW TO SAFEGUARD THE "DANGER ZONE" IN YOUR DRAINAGE PIPE



Like the suit that must be discarded because the seat of the pants is worn through, 75% of the average drainage pipe is still serviceable when it is consigned to the scrap pile.

It goes there *because the bottom is worn through.*

This doesn't happen to ARMCO Paved Invert Pipe. A smooth, thick bituminous pavement in the bottom of the pipe protects this danger zone from erosion . . . makes the *bottom last as long as the top.*

Where drainage is severely corrosive, you can specify the added protection of an Asbestos-Bonded coating for the complete pipe. This coating is immune to corrosive soils, acids, alkalies and gases.

Your culverts last longer, cost less per year of service, and you get full value out of your investment.

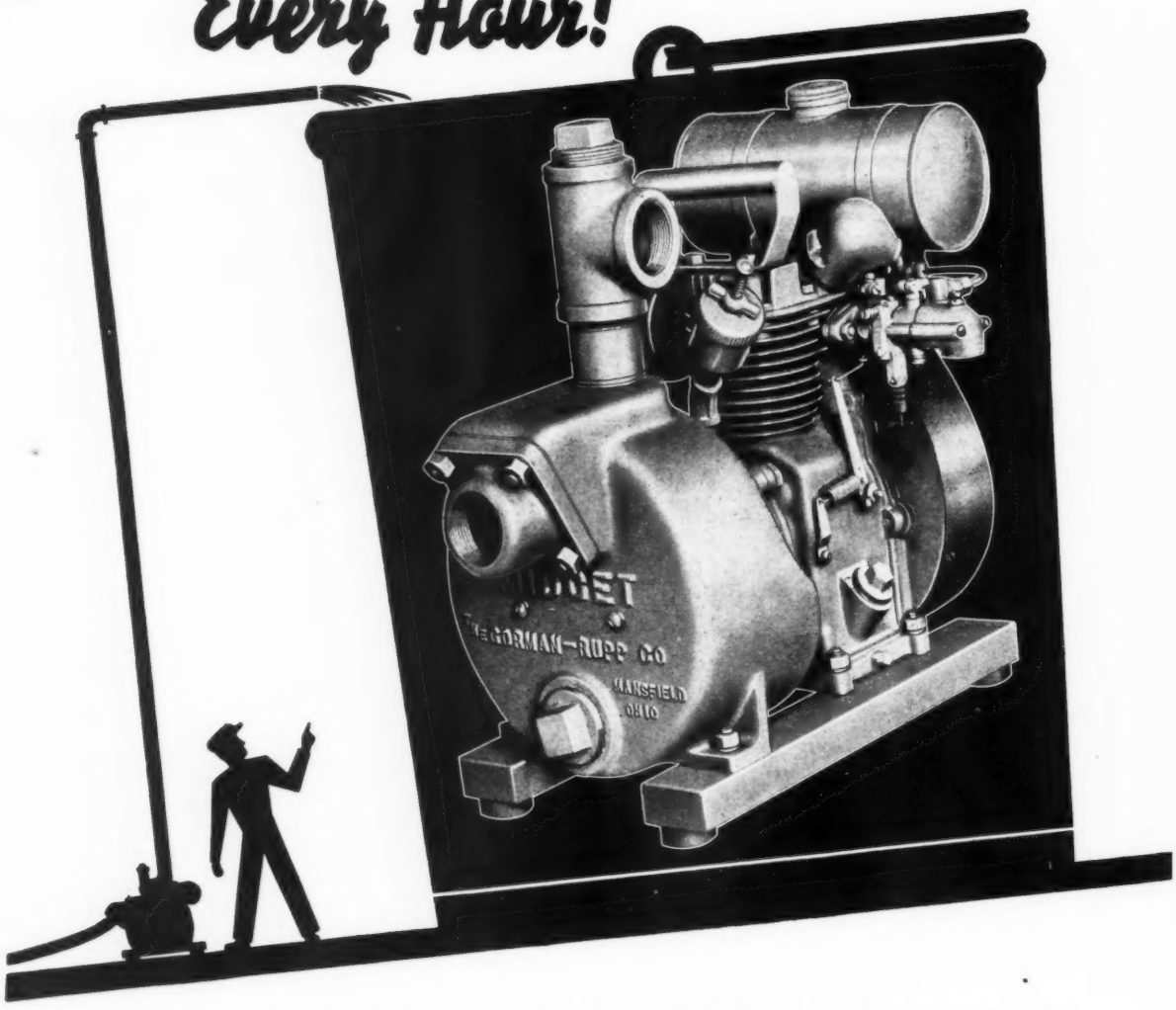
There is an ARMCO Pipe to meet every service condition. For utmost economy choose the one that meets your specific requirements. All ARMCO Pipe has flexible corrugated metal design to assure ample strength under high fills and heavy loads. Write Armco Drainage & Metal Products, Inc., 2545 Curtis Street, Middletown, Ohio.

ARMCO Paved Invert Pipe is reinforced on the bottom—the "danger zone" for erosion.

ARMCO

CORRUGATED METAL PIPE

Pumps 400 times its own Weight Every Hour!



This fully portable Gorman-Rupp pump that weighs only 60 pounds will handle 400 times its own weight in water every hour, against a 20-foot head. In gallons, this is 3,000 per hour. A mere handful of pump -- it does a man-sized job!

And it will keep on doing it. Priming is automatic. Just start the motor and you start the water, without making any adjustments. No muck or solids that can pass the intake will clog or harm the pump. Gorman-Rupp design is the simplest, most rugged ever offered in self-priming centrifugal pump. Compared on the basis of cost, power, or weight, a Gorman-Rupp pump will out-perform anything you can buy; and this statement is backed by a money back guarantee.

Whatever size your pumping job may be, up to 125,000 gallons per hour, your best choice is Gorman-Rupp.

THE GORMAN-RUPP COMPANY

Gorman-Rupp Pumps — Unsurpassed for Pumping Fast

332 BOWMAN STREET • MANSFIELD, OHIO

SURPLUS HOBART ARC WELDERS

200, 300 AND 400 AMPERE RATINGS

Three million dollars worth of surplus Hobart Arc Welders *must* be sold between May 15th and June 15th. Most of this equipment is of the MG type but some quantity is available in gasoline driven units. Arrangements may be made to inspect the offered items. Largest inventories are located at Boston, Detroit, Cleveland, Chicago, Atlanta, Kansas City, Richmond and Philadelphia—but information on availability, condition and location may be obtained at any of the War Assets Administration Regional Offices listed below. The equipment will be sold on a "where is, as is" basis . . . used or unused . . . and priced accordingly. For full information contact the nearest office listed below or check and mail this coupon.

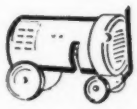
ALSO MANY OTHER TYPES OF WELDING AND FLAME CUTTING EQUIPMENT

LINCOLN

Hundreds of Lincoln Arc Welders in the popular 300-400 Ampere size are also available; some gasoline engine driven.

WESTINGHOUSE

Flexarc equipment for production or construction operations is available in smaller quantity. Also other standard makes and ratings.



RESISTANCE WELDERS

Spot Welders located in Philadelphia, Detroit, Chicago, Los Angeles, Cleveland and Kansas City; *Seam Welders* in Cleveland, Chicago, Detroit, Birmingham, Boston and Philadelphia. Also *Flash Welders.*

WELD POSITIONERS

In standard sizes and types, are located in Detroit, Boston, Chicago and New York.

FLAME CUTTERS

Save production time and money with portable or stationary, single or multiple torch flame cutting machines. All types of gas cutting equipment available for quick sale.

VETERANS OF WORLD WAR II—To help you in purchasing surplus materials, a veterans' unit has been established in each War Assets Administration Regional Office.

FREE SALE FACTS

To War Assets Administration:
Please send me information prior to your sale on the availability, condition and location of Hobart Arc Welders of the following

types: ..... **and ratings:** .....

....

....

I am also interested in:—

- ☐ LINCOLN ARC WELDERS
- ☐ WESTINGHOUSE ARC WELDERS
- ☐ .....ARC WELDERS (other)
- ☐ SPOT, SEAM, FLASH WELDERS
- ☐ WELD POSITIONERS
- ☐ FLAME CUTTERS

Name .....

Firm .....

Address .....

City ..... State 176-2

All items subject to prior sale

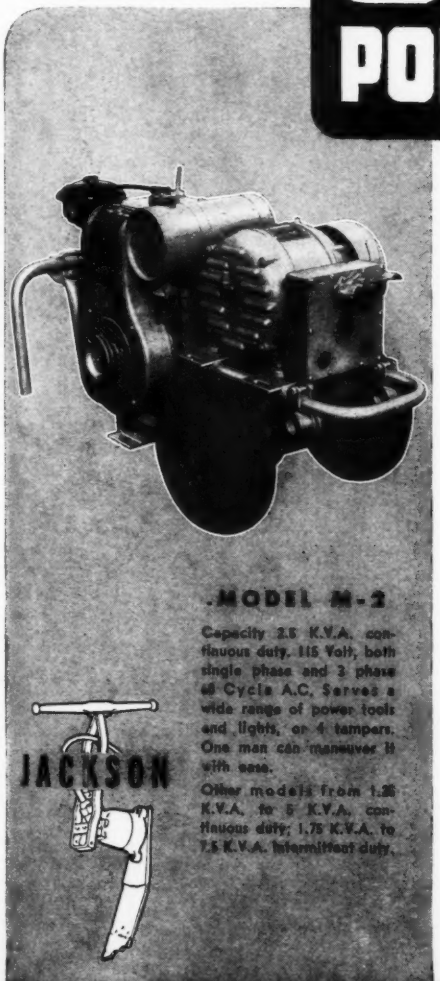
WAR ASSETS ADMINISTRATION

OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver Detroit · Helena · Houston · Jacksonville · Kansas City, Mo. · Little Rock · Los Angeles · Louisville Minneapolis · Nashville · New Orleans · New York · Oklahoma City · Omaha · Philadelphia Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane Cincinnati · Fort Worth (Telephone 3-5381)

Your bridge work sho'nuff is a partial — without

JACKSON PORTABLE *Power Plants*



MODEL M-2

Capacity 2.5 K.V.A. continuous duty, 115 Volt, both single phase and 3 phase 60 Cycle A.C. Serves a wide range of power tools and lights, or 4 tampers. One man can maneuver it with ease.

Other models from 1.25 K.V.A. to 5 K.V.A. continuous duty; 1.75 K.V.A. to 7.5 K.V.A. intermittent duty.

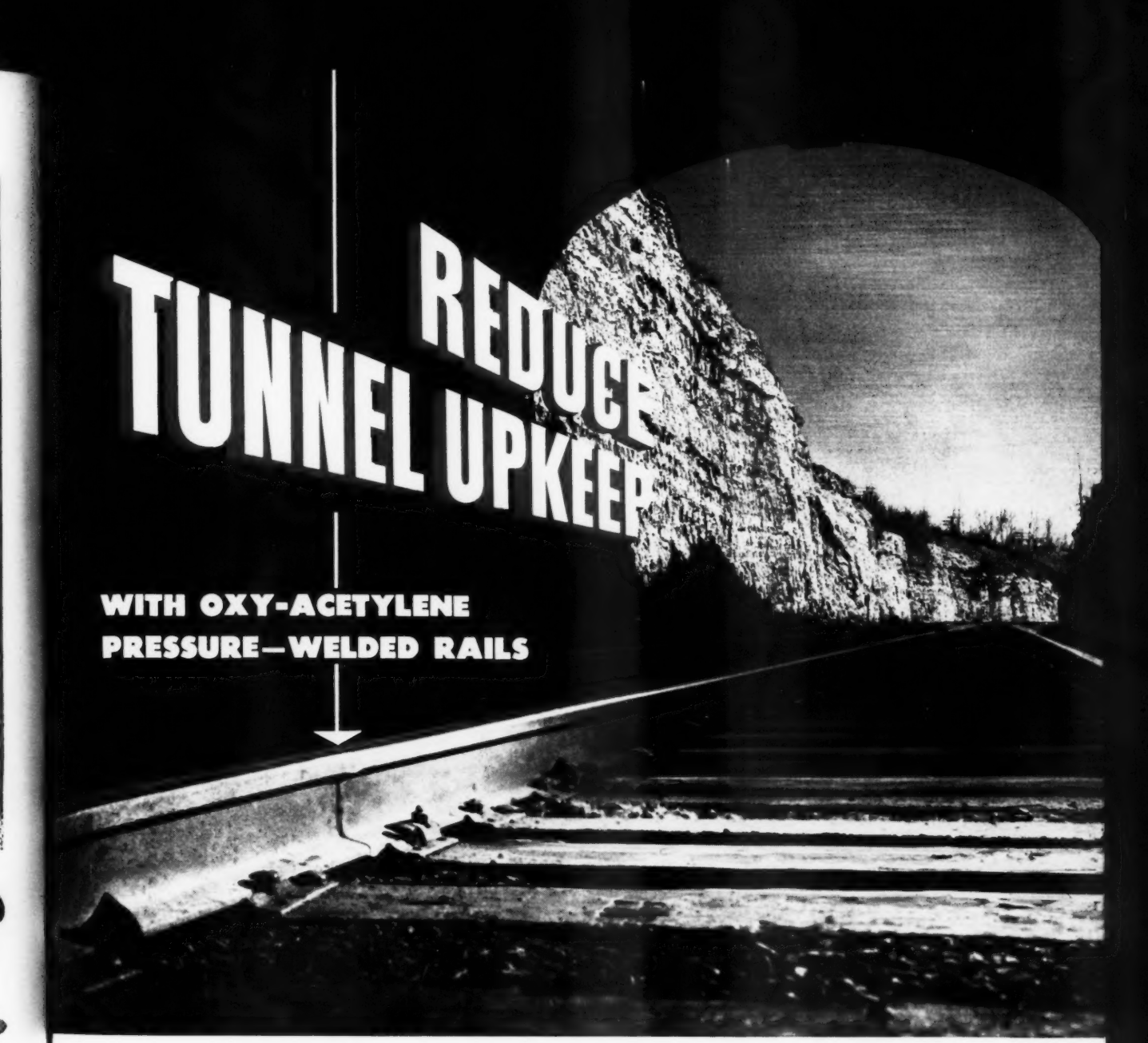
With the NEW Trouble-free, No Maintenance

PERMANENT MAGNET GENERATORS

To get full effectiveness from the many time and money saving electrically operated B&B tools now used, you need power plants that are ready to deliver every minute of the day. You need JACKSONS with their time proved, husky engines driving the new permanent magnet generators which require absolutely no adjustment and no maintenance other than lubrication. Time out for replacing brushes, adjusting tension, and dressing commutators and collector rings is a thing of the past with these new power plants. And remember that a 10 minute hold up, multiplied by the number of men in the gang, means an important loss in both man-hours and money.

Teammates of the famous JACKSON Vibratory Tie Tampers — the "super" combination for ballast placement — these new JACKSONS provide dependability such as never has been offered by any other Portable Power Plants, and they deliver single phase as well as 3 phase, 115 Volt, 60 Cycle A.C. to their full rated capacity. Write for complete information, NOW!

ELECTRIC TAMPER & EQUIPMENT CO. Ludington, Mich.



Continuous pressure-welded rails offer unusual advantages in locations such as tunnels, where track maintenance is difficult and costs are high.

Pressure-welded rails eliminate the need for joint bars, bolts, and bolt holes — so there are no openings or surfaces where moisture, brine drippings, or chemical-bearing fumes can lodge and thus act as starting points for corrosion.

Costs of installing continuous rails compare favorably with similar costs for standard-length rails. In recent experience a means has been developed for handling and laying long continuous lengths of rail by small gangs using available light equipment.

Your Oxweld representative will be glad to tell you how oxy-acetylene pressure-welded rails can be used for any location on your road.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
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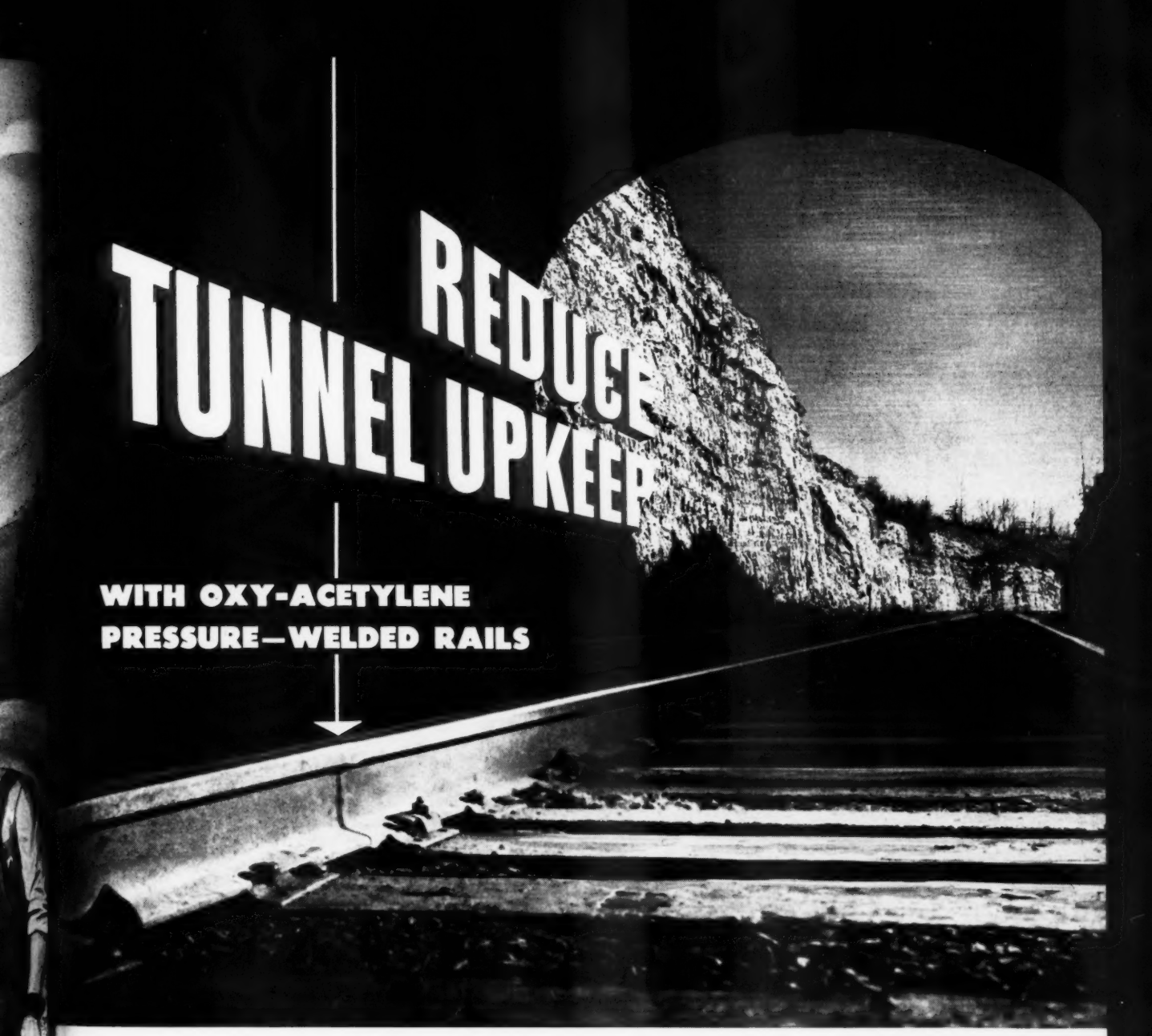
Carbide and Carbon Building Chicago and New York

What Trackmen Say About

THE IMPROVED FAIR

Rail Anchor



REDUCE TUNNEL UPKEEP

WITH OXY-ACETYLENE PRESSURE—WELDED RAILS

Continuous pressure-welded rails offer unusual advantages in locations such as tunnels, where track maintenance is difficult and costs are high.

Pressure-welded rails eliminate the need for joint bars, bolts, and bolt holes — so there are no openings or surfaces where moisture, brine drippings, or chemical-bearing fumes can lodge and thus act as starting points for corrosion.

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THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
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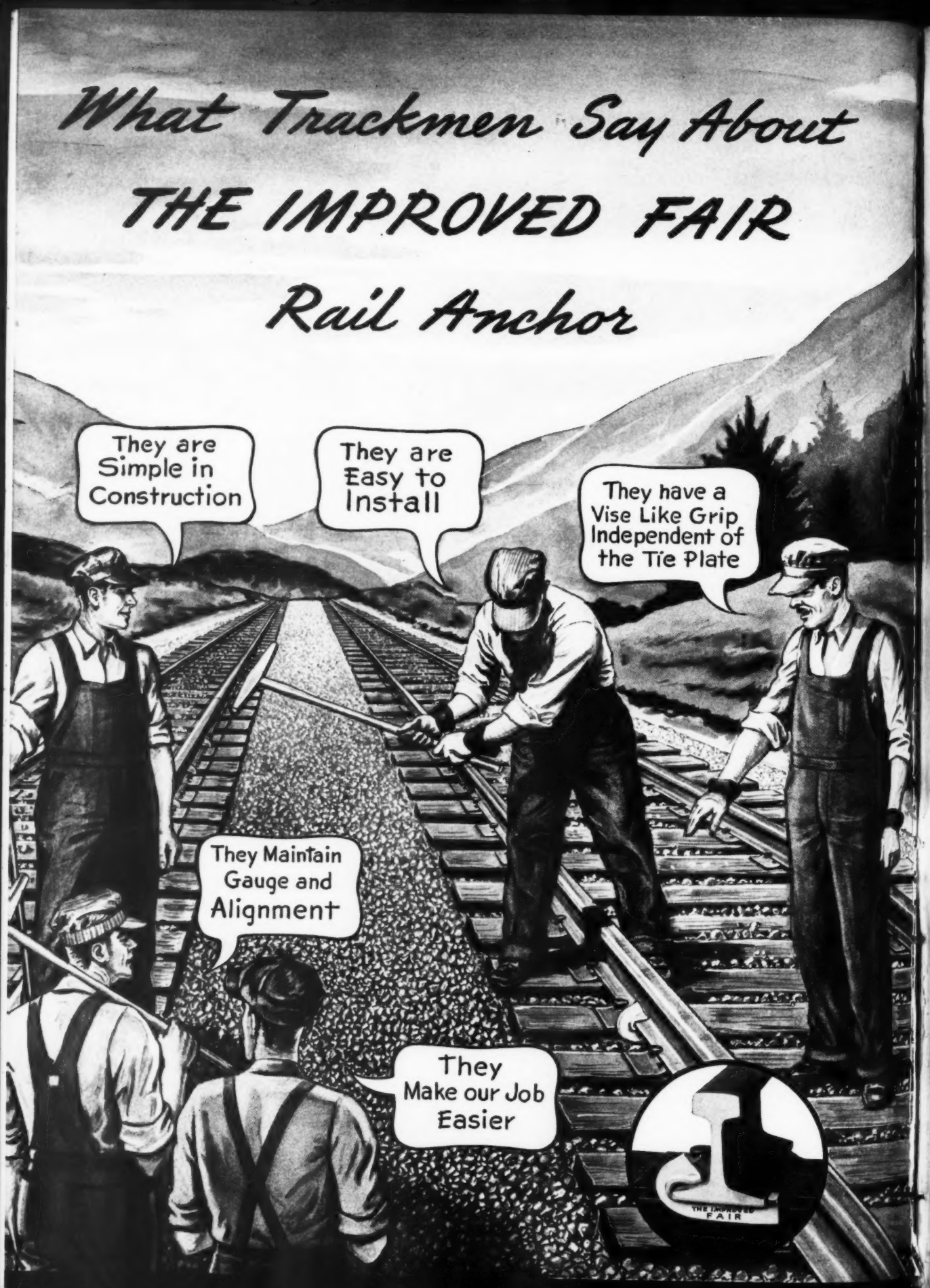
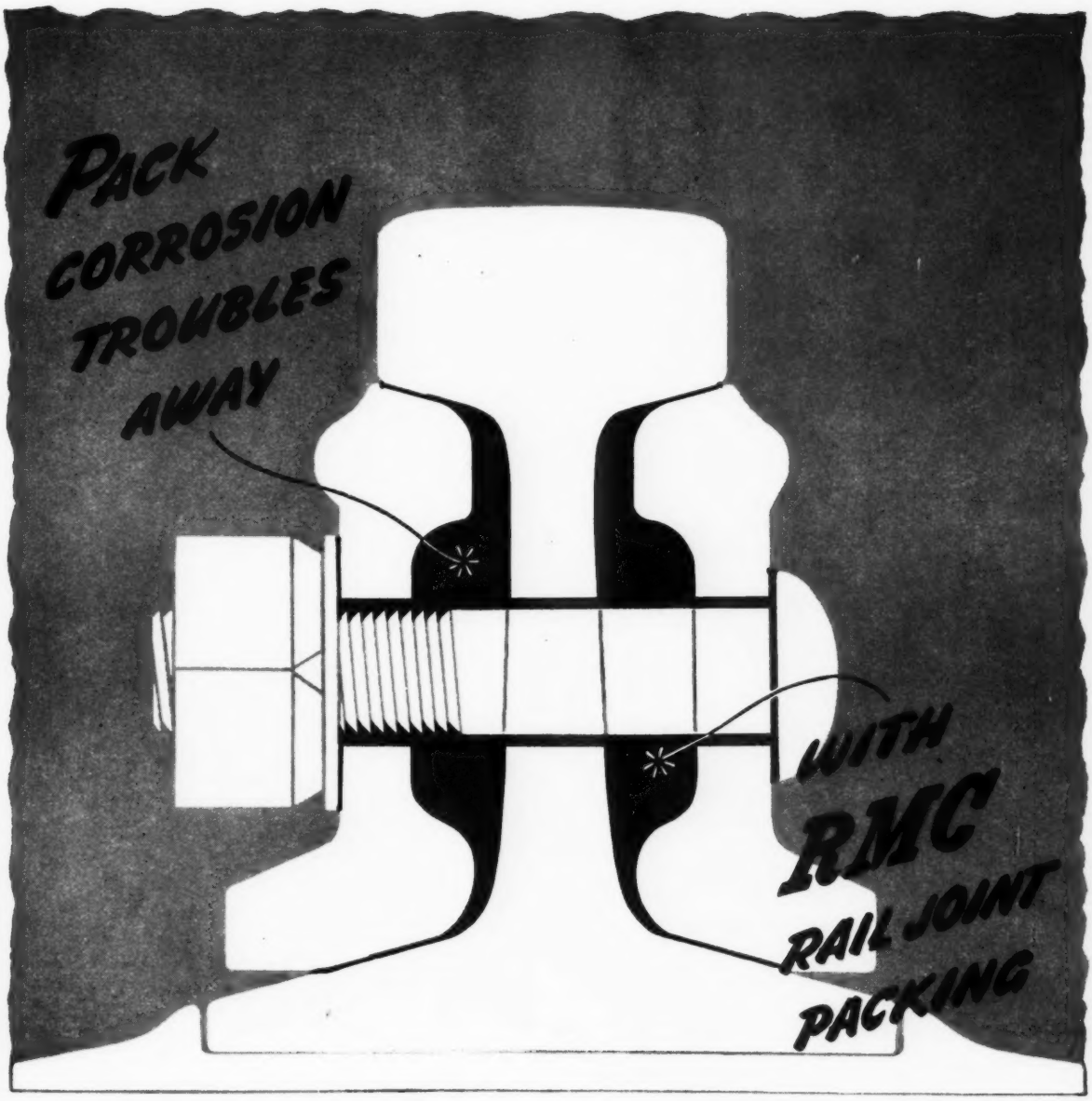
Carbide and Carbon Building Chicago and New York

OXWELD RAILROAD SERVICE

What Trackmen Say About THE IMPROVED FAIR Rail Anchor





One application of RMC Rail Joint Packing stops rail joint corrosion for the life of the joint. It is the modern method of permanently protecting rail joints and has been used successfully on millions of them by leading roads. In addition to preventing corrosion, RMC Packing assures that properly tensioned bolts will not "freeze" the joint and cause kinked or humped track. Write today for complete information.

RAILWAY MAINTENANCE CORP.

PITTSBURGH 30, PENNSYLVANIA

Amazing NEW POWER TRACK DRILL

-- look at these
OUTSTANDING FEATURES:

- **FAST-ACCURATE** . . . *Drills holes in 30 seconds, adjustable for complete accuracy.*
- **COMPACT-LIGHT** . . . *Weighs only 130 lbs., easy to carry.*
- **SAFE-ONE MAN OPERATION** . . . *Fool-proof gasoline engine starts easy, packs plenty of power — entirely operated by one man.*
- **LOW COST-JOB TESTED** . . . *Proved on the job — one railroad reports a saving of over $600.00 the first month, over manually operated drills.*

The new Buda Power Track Drill is the answer to railroad men's needs for a simple, light weight and low cost power drill that will speed drilling operations. This sturdy power drill will soon pay its own way by saving time and improving work. Call or write for Bulletin 1233.

(ABOVE): Drills at the narrow rail sections.
(BELOW): Drill is quickly removed from rail by a pull on the foot lever.

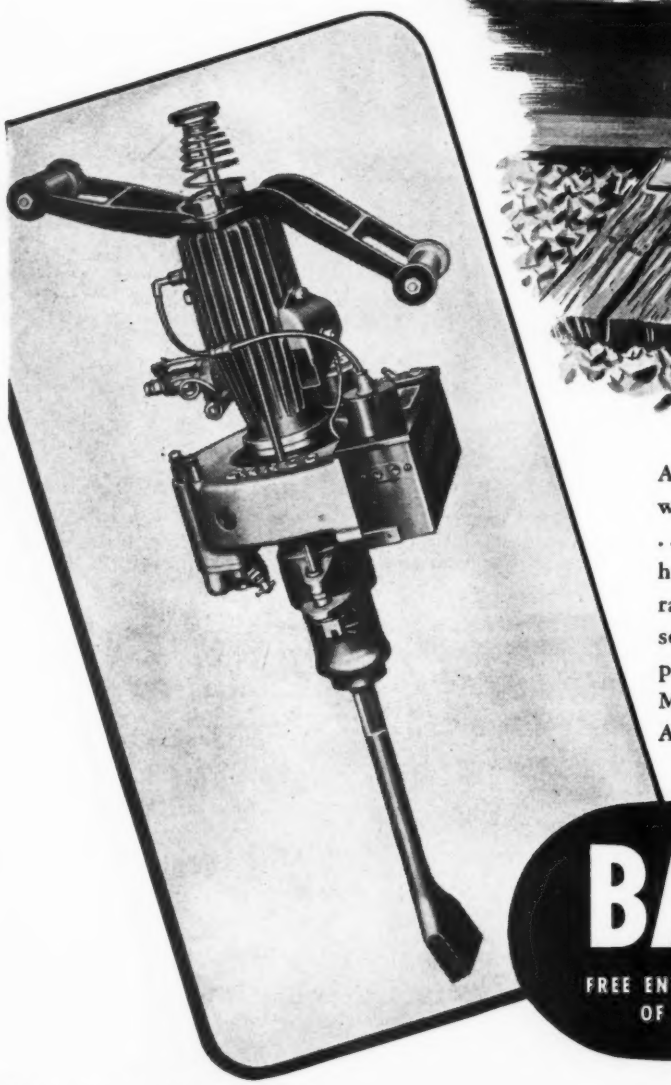
BUDA

15403 Commercial Avenue
HARVEY *(Chicago Suburb)* ILLINOIS

BUDA "All Purpose" Jacks

BUDA "Chore Boy"

SIMPLIFIES YOUR TRACK MAINTENANCE



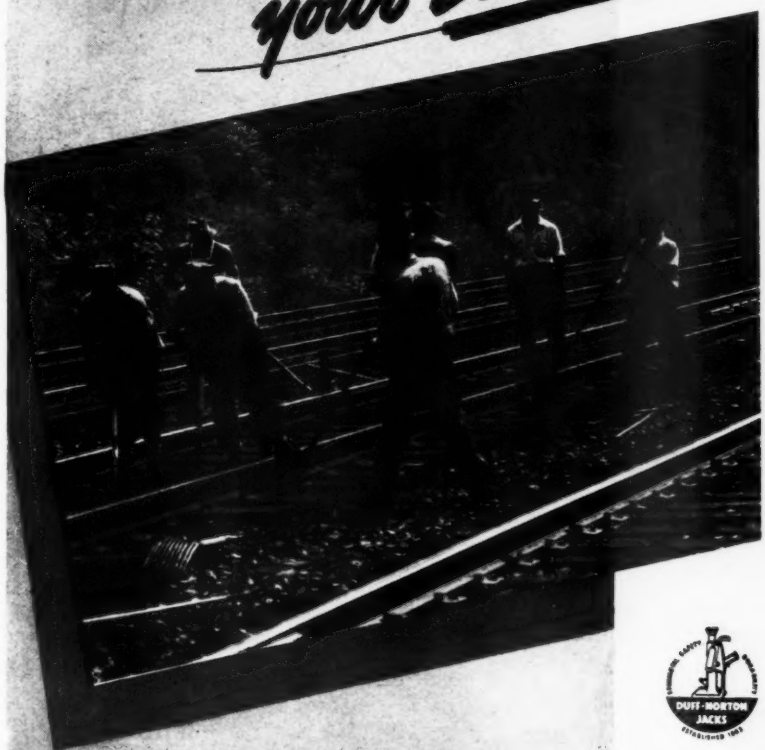
A Barco Unit Tytamper is a star-performer wherever it's put to work...saving man-hours . . . staying on the job . . . standing up to the hardest going. That is why so many leading railroads now provide section gangs with this self-contained, easily operated, portable tamper. Complete details on request. Barco Manufacturing Co., Not Inc., 1805 Winnemac Avenue, Chicago 40, Illinois.

BARCO UNIT TYTAMPER

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

DUFF NORTON
GENUINE BARRETT
TRACK JACKS
your Best Bet for

DEPENDABILITY
EASY OPERATION
LONG SERVICE LIFE



Duff-Norton Genuine Barret Track Jack No. 117—Single Acting

There is a safe, dependable Duff-Norton Track Jack for every job. The Single Acting Jack illustrated at right is ideal for *section gangs* since their work consists mainly of surfacing and lining, requiring only a low lift. The Double Acting Duff-Norton Track Jack is ideal for *extra gangs*—the load is raised on both the upward and downward strokes of the operating lever for high speed lifting. Write for the complete Duff-Norton Catalog.

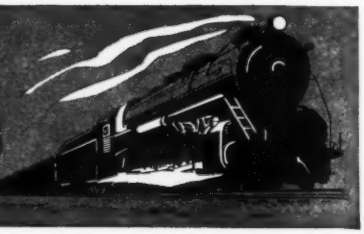
The DUFF-NORTON MANUFACTURING COMPANY
PITTSBURGH, PA.

Canadian Plant:
COATICOOK, QUEBEC

Representatives in Principal Cities

STANDARD ENGINEERS NOTEBOOK

CALOL RPM



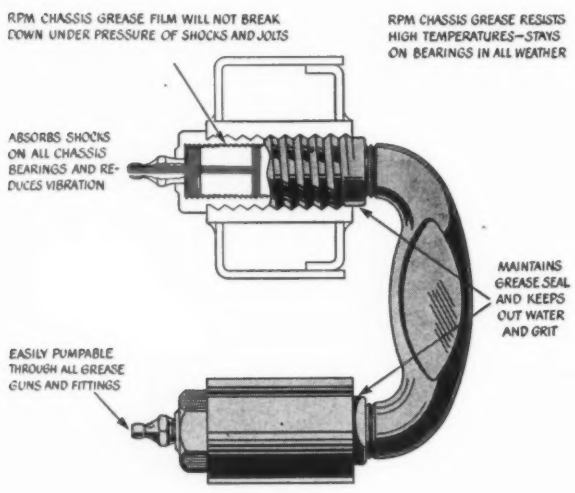
Shock-absorbing grease reduces shackle wear

Because it contains a special stringiness agent that keeps a tenacious lubricant film on shackle and other chassis bearings, RPM Chassis Grease will eliminate squeaks and cut wear to a minimum.

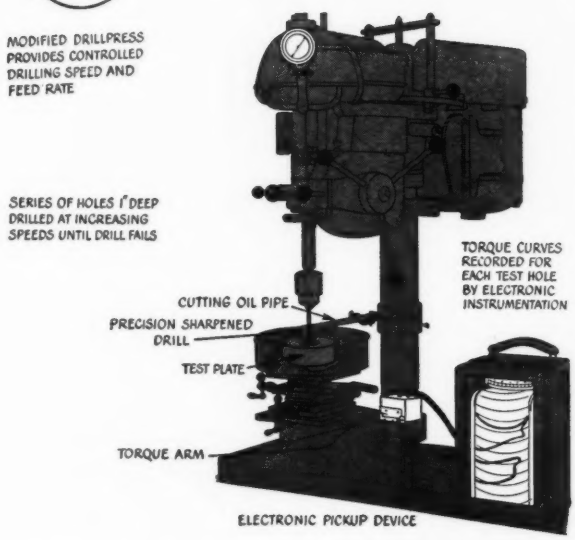
Besides using it on chassis bearings, many truck and bus operators lubricate heavy-duty tractor fifth wheel bearing surfaces with RPM Chassis Grease.

The tough lubricant film acts like a cushion. It absorbs countless shocks imposed on bearings and will not rupture even under an overload. This unusual ability also reduces vibration and makes vehicles ride smoother.

Highly resistant to heat and moisture, RPM Chassis Grease seals out water and grit on and at the edges of bearings. It may be applied easily in cold weather and protects vital wear-points in summer.



U-TYPE SPRING SHACKLE



ELECTRONIC PICKUP DEVICE

All Calol Cutting Fluids get breakdown test

To make sure that every Calol Cutting and Soluble Oil will preserve machine tools for maximum periods and produce the finest possible finish on the work for which it is recommended, Standard of California scientists developed the Drilling Torque Tester.

A modified drillpress, the speed and feed rate of which can be controlled, is used. For each test, a series of holes 1 inch deep is drilled with a precision-sharpened drill into a test plate. A constant drill feed is maintained with speeds increasing 100 rpm for each test hole. An electronic device records the torque curve for each hole.

The oil being tested is applied to the tool and work by a regular flow pipe. Oils are rated in terms of the speed at which drill failure occurs. Drill failure is indicated by a peak on the torque curve.

Every Calol Cutting Oil and Soluble Oil is evaluated in this "breakdown" test. For complete information about Calol Cutting Fluids write for the free booklet on that subject.

For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Col.; Standard Oil Company of Texas, El Paso, Texas.

FOR EVERY JOB A **STANDARD OF CALIFORNIA** TEST-PROVED PRODUCT

Picture of Railroad Progress With INTERNATIONAL HARVESTER POWER

● POWER IS THE INDEX OF PROGRESS—especially in the improvement and reconstruction of America's railroads. All along the line, mighty crawler tractors are clearing the way for better, straighter roadbeds—for high-speed, super-safe transportation. And best of all, this power is *off the track*—where it won't interfere with normal traffic.

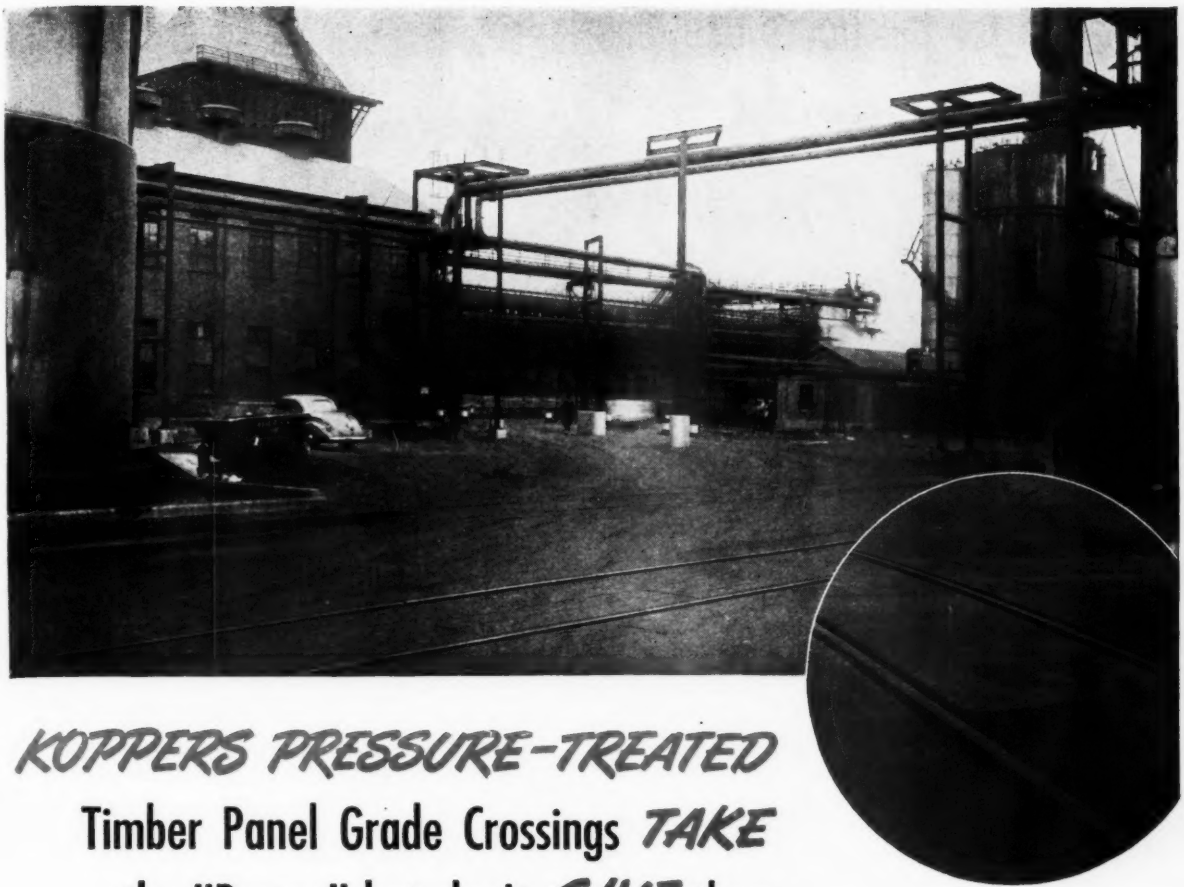
A large percentage of these tractors are red-coated Internationals and there are a lot of good reasons for that fact. On thousands of jobs, International Diesel Crawlers, equipped with bulldozers and 'dozer shovels, have proven themselves to be the standard of stamina—the product of advanced engineering and precision construction. Better balance, lower fuel consumption and rugged resistance to wear make Internationals misers with maintenance costs but prodigal with power.

Your International Industrial Power distributor has the facts you want about International Diesel Crawlers and Power Units. He'll be glad to give you the answers to your power problems.

Industrial Power Division
INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago 1, Illinois

Listen to "Harvest of Stars" Every Sunday, 2 p.m. Eastern Time! NBC Network

INTERNATIONAL Industrial Power



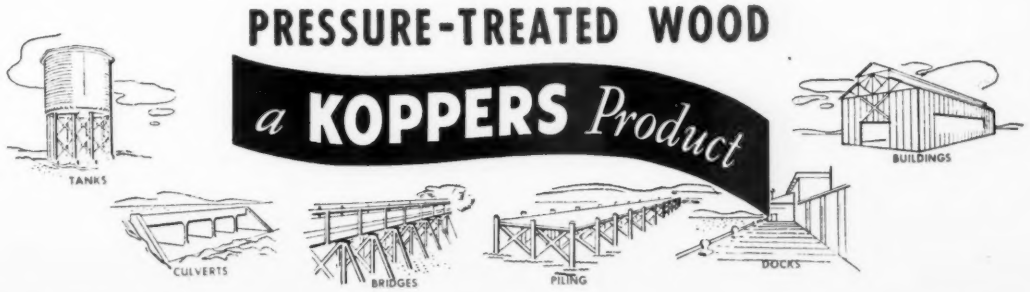
KOPPERS PRESSURE-TREATED
Timber Panel Grade Crossings *TAKE* the "Bumps" but don't *GIVE* them

These pictures show one important advantage of Koppers Creosoted Timber Panel Grade Crossings. In spite of constant heavy truck traffic, the traffic surface is maintained at installed grade, does not sag, spall, "washboard" or disintegrate.

There are other important features and advantages that show up during installation . . . and in use. Built up from selected hardwood members that are machined, pressure-creosoted and assembled with spiral-drive dowels, the individual panels come ready for installation. They can be handled by the workmen; no crane is required.

Thorough pressure-treatment gives dependable protection against decay. Careful factory fabrication results in traffic loads being distributed over the entire panel, reducing stress and flexing of individual members. The panels can be easily lifted when the track is reworked under the crossing, and 100% re-use of serviceable parts is possible.

Engineering information on these crossings is condensed in a 4-page bulletin, "Koppers Creosoted Timber Panel Grade Crossing." We will be glad to send you a copy on request. Wood Preserving Division, Koppers Company, Inc., Pittsburgh 19, Pennsylvania.



Red Lead *halts* Rust-Producing ELECTRO-CHEMICAL ACTION

No other protective paint for metal has ever known such wide acceptance by industry, through the years, as Red Lead. And recent scientific research has disclosed that Red Lead's outstanding performance results from basic characteristics of the pigment itself.

Not the least important of these is the ability of Red Lead to halt electro-chemical action — the fundamental cause of rusting.

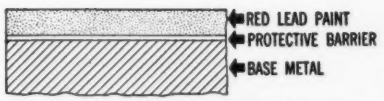
In this action weak currents are generated, due to physical and chemical differences in the metal and to other factors. These lead to corrosion of the iron.

These factors are always present, but their effects are eliminated by Red Lead.

Here's what happens: Red Lead, because of its singular composition, possesses properties which enable it to form a compact, tightly adherent, protective film, located at the interface of the metal and the paint coating. See cross section diagram above.

This film — so thin that it is not apparent to the human eye — is in very intimate contact with the metal, and its formation halts electro-chemical action — and the corrosion of the metal.

Once formed, it is essential that the continuity of the film be maintained — if the shield is to be effective. When Red Lead pigmented paint is used, any small breaks in the protective shield, due to abrasive action or otherwise, are readily healed. The metal remains in a rust-inhibited condition as long as Red Lead coats the surface.



The invisible safeguard against corrosion
This diagram shows the interfacial film, located at the metal and paint-film interface. The formation and the maintenance of this shield by Red Lead halts electro-chemical action . . . safeguards the metal against rust.

Specify RED LEAD for All Metal Protective Paints

The value of Red Lead as a rust preventive is most fully realized in a paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint. No matter what price you pay, you'll get a better paint for surface protection of metal, if it contains Red Lead.

Write for New Booklet "*Red Lead in Corrosion Resisting Paints*" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior protection. It also includes typical specification formulas. If you haven't received your copy, address nearest branch listed below.

* * *

The benefit of our extensive experience with metal protective paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6; Buffalo 3; Chicago 80; Cincinnati 3; Cleveland 13; St. Louis 1; San Francisco 10; Boston 6, (National Lead Co. of Mass.); Philadelphia 7, (John T. Lewis & Bros. Co.); Pittsburgh 30, (National Lead Co. of Pa.); Charleston 25, W. Va. (Evans Lead Division).

Dutch Boy
Reg. U. S. Pat. Off.
Red Lead

Pretty Soft!

THESE YOUNG CHEMISTS GOING SOUTH FOR THE SIX FALL AND WINTER MONTHS —FUNNY LOOKING "BAGGAGE"!

Who are they? - Get me a job like that!

THESE Reade Manufacturing Chemists have a job on their hands and they won't loaf all the time. As a matter of fact, they have been South before on a similar mission—LEARN MORE ABOUT THE HABITS OF VEGETATION—STUDY THE EATING HABITS OF LIVESTOCK.

Research work must go on if this subject of CONTROL OF WEEDS ON RAILROADS is to be more fully understood. It's a big job, for weeds cost railroads millions of dollars of loss per year in numerous ways and old Mother Nature never lets up in providing an ever increasing crop of grass and weeds.

READE MANUFACTURING COMPANY was the first company to attack this problem, way back in 1883 when labor cost only $.50 per day and when men worked twelve hours per day to earn their bread and butter. Our organization has been accumulating know how and facilities over the many years since, and when railroads call for weed killer or application service, it's serious business that must be worked out on a prearranged schedule.

CONSULT US ON YOUR WEED CONTROL PROGRAM

READE MANUFACTURING COMPANY

Executive Headquarters
135 Hoboken Avenue
Jersey City, N. J.

Service Headquarters
9500 Cottage Grove Avenue
Chicago, Illinois

PLANTS AT NUMEROUS RAILROAD CENTERS.

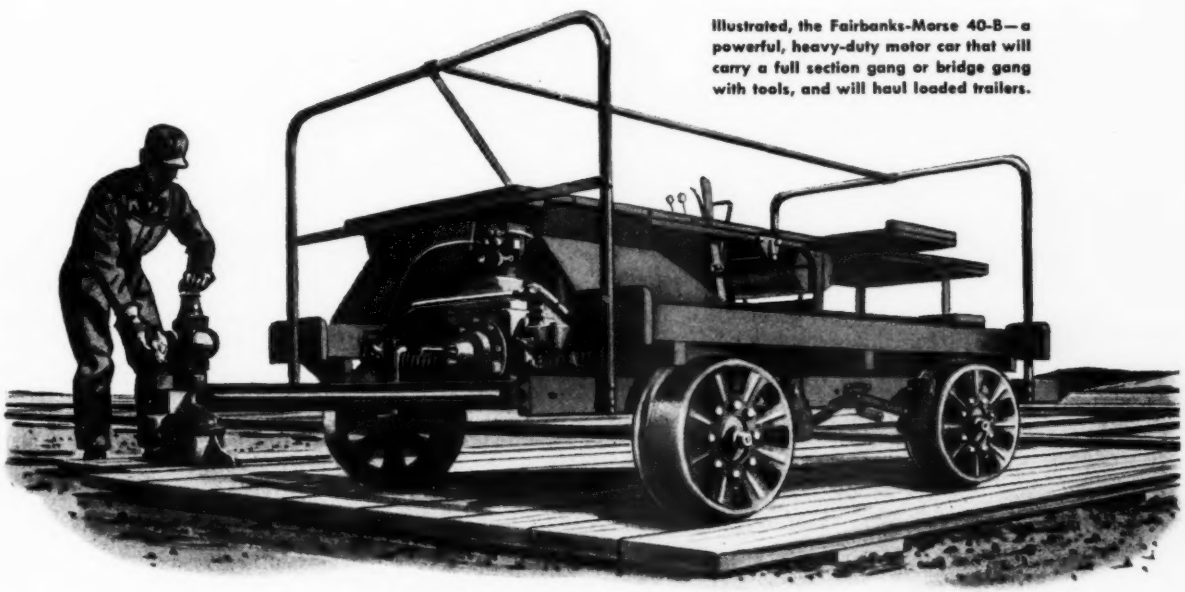
SEE FAIRBANKS-MORSE FIRST FOR MOTOR CARS

FIRST . . . because to merit motor car business from American railroads for more than 50 consecutive years, Fairbanks-Morse Motor Cars are *proved* dependable—safe—efficient.

The sturdy two-cycle reversible engine employed in most models has the extra power needed for grades and curves. Combined with the simple construction of the engine is lightness, especially essential to motor cars in this day of high-speed passenger and freight schedules.

Fairbanks-Morse makes a car for signal maintainers, for track inspectors, for superintendents, section or bridge gangs—many types all built under one guarantee by one manufacturer. For your motor car needs, specify "Fairbanks-Morse."

Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.



Illustrated, the Fairbanks-Morse 40-B—a powerful, heavy-duty motor car that will carry a full section gang or bridge gang with tools, and will haul loaded trailers.

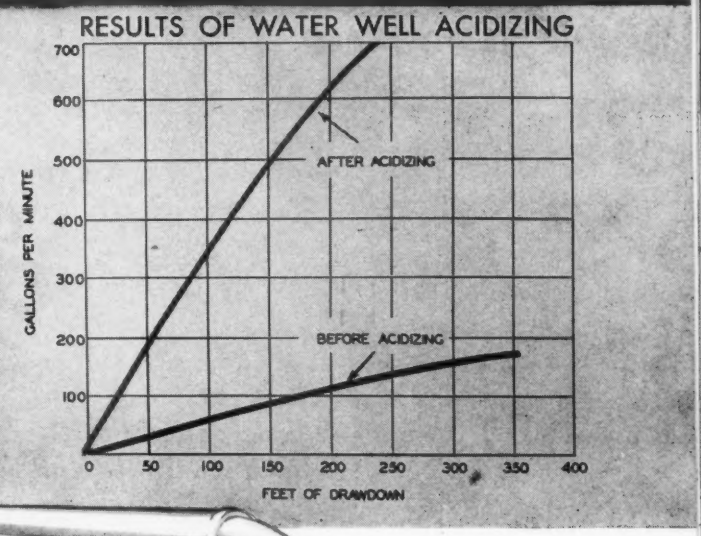
Fairbanks-Morse

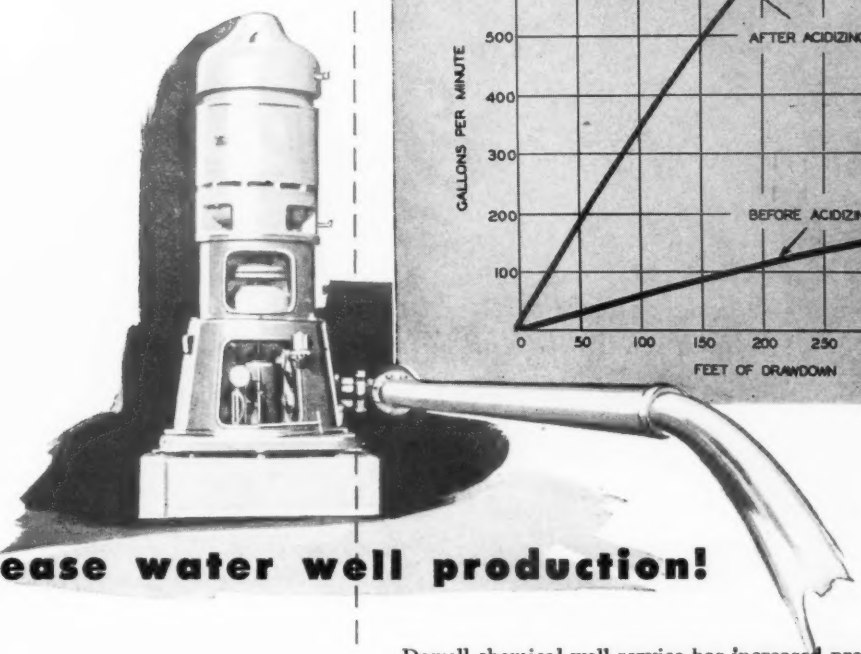
A name worth remembering

Diesel Locomotives • Diesel Engines
Scales • Motors • Pumps • Generators
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

DOWELL

Drawdown Curves showing the advantages to be obtained from proper chemical treating of water wells.





increase water well production!

Dowell chemical well service has increased production from thousands of water wells. The removal of retarding incrustations on screens and the enlarging of formation pores by chemical treatment permits more water to enter the well bore—and faster!

Dowell pioneered the well-acidizing field and its engineers have the know-how based on years of experience gained in treating thousands of wells. Ask Dowell to analyze your well—restore its production. Call the nearest Dowell office for a free estimate.

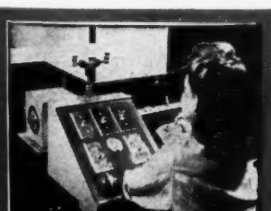
Ask for your copy of "More Power to America's Industry"—new color booklet which explains and illustrates Dowell's thorough chemical cleaning service.

DOWELL INCORPORATED, TULSA 3, OKLAHOMA

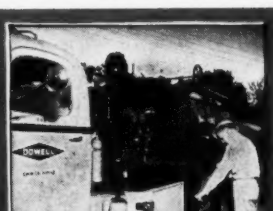
Subsidiary of The Dow Chemical Company

New York • Philadelphia • Baltimore • Buffalo • Cincinnati • Cleveland • Chicago • Detroit
St. Louis • Houston • Kansas City • Wichita • Pittsburgh • Mt. Pleasant, Mich. • Salem, Ill.
Long Beach, Calif., Casper, Wyo.: Dowell Affiliate—International Cementers, Inc.

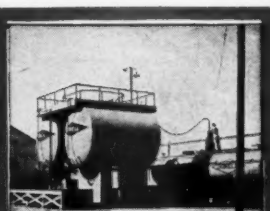
SPECIALISTS IN CHEMICAL CLEANING SERVICE



Dowell's experienced industrial engineers are backed by the complete research and technical facilities of The Dow Chemical Company.



Dowell's equipment is modern and complete—scientifically designed. Treating stations and chemical warehouses conveniently located



Dowell cleaning solutions are "tailor-made" to fit each job. All ingredients are of the highest quality, chosen for best results in your plant.

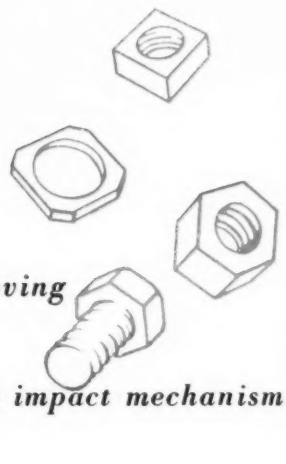
DOWELL

FOR INDUSTRIAL CHEMICAL SERVICE

NEW... *and Ready for Immediate*

PNEUMATIC IMPACT WRENCH

by Thor



MORE POWER— ***for Faster, Positive Driving and Removing of Nuts, Bolts and Cap Screws.***

LONGER LIFE— ***through amazingly simple, sturdy, new impact mechanism.***

EASILY THE MOST POWERFUL tool of its class, the new THOR Reversible Impact Wrench quickly and surely *drives and removes* nuts, bolts and cap screws up to ⅜" I.D. Far lighter and more compact—only 3¾ pounds in weight; 6 inches long—it is easy to handle even in hard-to-reach places. Pneumatic powered, it is extremely simple in construction for long life and fool-proof operation.

A revolutionary, new impact mechanism—exclusive with Thor—delivers *direct* blows that *automatically* assure maximum striking power. Because this mechanism is so simple . . . eliminating springs, gears, threads and screws . . . the tool *stays on the job longer without losing its original impact force!* Simplified design also lessens stress, permits use of sturdier parts and provides smoother operation—to reduce wear and substantially increase tool life.

Ready now for immediate delivery, the *new* Thor ⅜-inch capacity Impact Wrench will save you time and money on any heavy-duty job of driving and removing nuts, bolts and cap screws. Prove its superiority on your own work—your nearest Thor branch or representative will be glad to arrange an early demonstration.

INDEPENDENT PNEUMATIC TOOL COMPANY

600 West Jackson Boulevard, Chicago 6, Illinois

Birmingham Boston Buffalo Cleveland Detroit Los Angeles Milwaukee New York Philadelphia
Pittsburgh St. Louis Salt Lake City San Francisco Toronto, Canada London, England

Delivery!

ACTUAL SIZE

GRIP THROTTLE
Model No. 6

SMALLEST, LIGHTEST TOOL OF ITS CLASS!

HERE'S FULL POWER . . . LONGER!

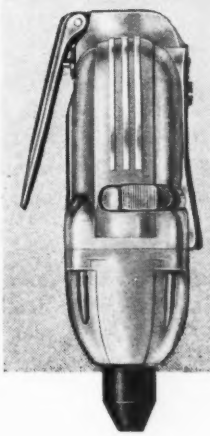
- New THOR high-power impact mechanism provides direct, *positive drive* to the impact spindle.
- *Stress is lessened* on the working parts by placing the two impact jaws at a *wider* radius to the spindle center.
- Because a new face for each jaw is *rotatively* delivered to the anvil for each blow, the impact jaws *naturally* wear longer—and wear *evenly* to retain full striking power.
- Short, rigid, spindle shank delivers blow *close to the work — provides powerful, positive impact.*

HERE'S HANDLING EASE!

- The lightest tool in its class —only 3¾ pounds.
- The *smallest* tool in its class —only 5⅞ inches long.
- Torque reaction to the operator is *practically eliminated* with smooth-hitting impact mechanism.
- Motor reverses quickly, simply by pressing convenient side button *without changing grip on handle.*

AUTOMATIC LUBRICATION!

- Oil reservoir in handle automatically feeds proper amount of lubricant to motor with compressed air.



LEVER THROTTLE
Model No. 61

For vertical suspension work, furnished in place of grip throttle, if specified, at no extra charge.

Coming Soon!

MORE NEW THOR IMPACT WRENCHES—in ¼", ⅜", ½" and 1¼" CAPACITIES. *Watch for Them!*

Thor

PORTABLE POWER TOOLS

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS

MECHANICAL AND HYDRAULIC PIPE CLEANING

PITTSBURGH PIPE CLEANER CO.

133 DAHLEM STREET . . . . . PITTSBURGH 6, PENNA.

PITTSBURGH, PHILADELPHIA, BALTIMORE, WASHINGTON, NEW YORK, BUFFALO, CHICAGO, CINCINNATI, ST. LOUIS, DETROIT

In throwing a lariat and in Pipe Cleaning

AN EXPERT GETS THE BEST RESULTS

Roping a steer needs the throw of an expert, and cleaning pipes takes specialized tools, skilled engineers and plenty of experience to clean them the way they should be cleaned. Being specialists in the field, Pittsburgh Pipe Cleaner Company has all of the fundamentals to get the best results for you.

For many years we have cleaned—either hydraulically or mechanically—all types of pipes and sewers for railroads. It is this understanding of railroad needs, plus our continual research to do the job better, that makes Pittsburgh the logical choice for your pipe cleaning requirements.

Write today for information about our complete contract pipe and sewer cleaning service.

BJ

Pneumatic Sponge

A HIGH-HEAD PUMP FOR "MOPPING UP" LIQUIDS CARRYING ABRASIVE SOLIDS

Single-Stage Standard Sponge for Pumping-Heads up to 160 ft.

Two-Stage Pneumatic Sponge for Pumping-Heads up to 300 ft. Since each stage is a complete pumping unit, this pump can be separated into two single-stage pumps for lower-head service.

This rugged, air-motor driven centrifugal pump soaks up a lot of punishment. Designed for "mopping up" liquids containing a high percentage of solids, it passes sand, silt and other abrasives up to ⅝" diameter. It is used in mine shafts, coffer dams, caissons, sumps, bilges, manholes, etc.

The Pneumatic Sponge is compact, lightweight, portable. It operates in any position. The rotary air motor, equipped with governor and variable speed control, operates on compressed air at 70 to 100 psi.

Write for detailed bulletin.

Two-port, non-clogging, heat-treated Meehanite impeller. Stainless Steel impeller shaft is supported by heavy, sealed, duplex thrust and radial ball bearings. A renewable bronze wear ring, matching the impeller, is mounted in the suction cover. Semi-steel volute case. Meehanite connector between air motor and pump.

Three types available

(Performance data are for operation at 90 psi air pressure)

SIZE AND TYPE	CAPACITY	HEAD
2½" Single-Stage Sponge	25 to 125 gpm	50 to 160 ft.
2½" Double-Stage Sponge	25 to 100 gpm	130 to 300 ft.
3" Single-Stage, Low-Head Sponge	120 to 300 gpm	25 to 57 ft.

Byron Jackson Co.

LOS ANGELES 54, CALIFORNIA

Offices in Principal Cities

No. 209 of a Series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Our Advertising Pages

May 1, 1946

Dear Readers:

It was a matter of keen interest to me recently to have additional evidence of how some of you read Railway Engineering and Maintenance. I had just handed a copy of our March issue, one of the first off the press, to an important maintenance officer who had called at my office, expressing the hope that he liked it. Frankly, I was thinking primarily of the feature section, to which we editors had given a lot of special attention and thought, and was a little anxious for him to turn immediately to that section.

But that was not his idea of how to read Maintenance. Starting with Page 1 of the advertising, he turned page after page slowly and deliberately, even stopping to comment on specific advertisements. Naturally, I was interested, and questioned his manner of reading, to which he replied that this was a habit with him--that he got so much out of the advertising pages in even a quick perusal of them, that he always turned to them first, especially when on "short time", reserving the feature articles until he could read them more leisurely.

Coming on top of many previous indications that you men in the field find our advertising pages attractive and of real value, this comment was of more than ordinary interest and satisfaction to me, because of the continuing effort that has been made on our part to promote both attractive and informative advertising in our pages--the kind that will not only appeal to you, but that will give you information of maximum interest and help.

And we have reason to believe that most of the advertisements in our issues from month to month are attractive and of help to you. Only during the last month four of our good advertisers--E. I. duPont de Nemours & Company, Inc., Johns-Manville, R. G. LeTourneau, Inc., and the National Lead Company—were named among the winners in the fourth annual contest of Associated Business Papers, in which the advertising entries were judged on "informative usefulness to readers, adequacy and validity of objective, relative results obtained, and efficient use of space".

In advising us of the honor conferred upon his company, the head of LeTourneau's Advertising and News Bureau wrote to me in part as follows: "So, it really pleases us to tell you that our 1945 campaign in your publication was a big factor in our winning this coveted award. The fine co-operation we've received from you is really appreciated".

In turn, we congratulate LeTourneau and those other winners among our advertisers on the splendid advertising copy that has gained for them such high recognition. With such copy, and the much equally good copy of other advertisers in our issues from month to month, it is not surprising that so many of you find our advertising pages of real value, often reading them ahead of the feature section.

Sincerely,

Neal D. Howard
Editor

NDH:ag

Huge teak logs are handled almost like toothpicks by trained elephants in parts of the Orient. Feats of great strength are common among the docile, Indian work elephants in some oriental lands but Western Civilization depends upon flexible specialized machinery to perform its varied tasks. On the American railroad scene, Fairmont Railway Motor Cars and Work Equipment have long been recognized for their performance on the job. Railroad men know that the performance of their Fairmonts is insured by the built-in strength that comes from the quality materials and skilled manufacture in these cars.

Fairmont

Fairmont Railway Motors, Inc., Fairmont, Minnesota

Gang cars like the Fairmont A3 Series D are not only noted for their strength, but also for their flexible performance. This versatile Fairmont drives in reverse as easily as forward. Many roads use this car for heavy duty section work, for towing extra gangs and weed mowers. For complete details ask for Bulletin 530.

Performance
ON THE JOB COUNTS

OF ALL THE CARS IN SERVICE TODAY . . . MORE THAN HALF ARE FAIRMONTS

Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 West Adams St., Chicago 3

New York 7, 30 Church Street

Cleveland 13, Terminal Tower

Washington, D.C., 4, 1081 National Press Bldg.

Seattle 1, 1033 Henry Bldg.

San Francisco 4, 300 Montgomery St.

Los Angeles 14, 530 West 6th St.

Dallas 4, 4518 Roland Ave.

Subscription price in the United States and Possessions and Canada, 1 year $2, 2 years $3; foreign countries, 1 year $3, 2 years $5. Single copies, 35 cents each. Address H. E. McCandless, Circulation Manager, 30 Church Street, New York 7, N.Y.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.)

PRINTED IN U.S.A.

Railway Engineering and Maintenance

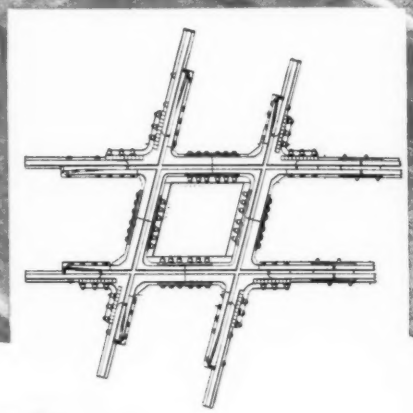
NAME REGISTERED U. S. PATENT OFFICE

MAY, 1946

Depth Hardened

SOLID MANGANESE STEEL

CROSSINGS



Insure smooth riding . . .

Racor crossings of INTEGRAL BASE DESIGN are reinforced with a continuous base assuring full contact on crossing plates or timbers.

Bearing walls at intersections withstand traffic impact as well as provide sturdy support for the factory DEPTH HARDENING of tread surfaces. This DEPTH HARDENING process greatly retards batter at intersections and resultant crossing and equipment maintenance.

RACOR
TRADE MARK

Write today for your copy of our new and complete TRACK SPECIALTIES CATALOG

Pioneers in the Development and Manufacture of

DEPTH HARDENED CROSSINGS	SAMSON SWITCH POINTS
AUTOMATIC SWITCH STANDS	VERTICAL SWITCH RODS
MANGANESE STEEL GUARD RAIL	REVERSIBLE MANGANESE STEEL CROSSINGS

World's most complete line of Track Specialties

AMERICAN
Brake Shoe
COMPANY

RAMAPO AJAX DIVISION

AMERICAN BRAKE SHOE COMPANY
332 So. Michigan Avenue, Chicago 4, Illinois

NEW YORK, N. Y. • HILLBURN, N. Y. • NIAGARA FALLS, N. Y. • WASHINGTON, D.C. • ST. LOUIS, MO. • EAST ST. LOUIS, ILL.
SUPERIOR, WIS. • DENVER, COLO. • PUEBLO, COLO. • LOS ANGELES, CALIF. • HOUSTON, TEXAS • SEATTLE, WASHINGTON
CANADIAN RAMAPO IRON WORKS, LTD., NIAGARA FALLS, ONT.

Ramapo's greater experience and facilities are ready to serve you.

Railway Engineering and Maintenance

Railway Profits—

Far From What Most Employees Think They Are

Despite the unquestioned loyalty of the large majority of railway employees to their industry and their liking for their jobs, as pointed out in last month's issue discussing broadly the Opinion Research Survey among railway employees conducted jointly by this publication, Railway Age and Railway Mechanical Engineer, it cannot be said, unfortunately, that the knowledge of employees as to the economic situation of their industry, from the standpoint of profits earned, is remarkable for either its extent or its accuracy. In fact, with 42 per cent of all employees (41 per cent m. of w. & s.) fearing that post-war competition will bring hard times to the railroads, as disclosed by the survey, the lack of information, or the prevalence of misinformation, among so many employees on the important matter of earnings is a serious drawback to an improved situation, and best management-employee relations.

Obviously, if the railways are to meet post-war competition successfully, they must operate at a profit; that is, after paying necessary operating expenses, fixed charges and taxes, they must be able to pay a return to the hundreds of thousands of people, including employees, who have invested their money in them, and whose money the railroads must continue to attract in large amounts to be able to make the improvements in equipment and fixed property essential to the improved service that alone can meet competition successfully.

That railroad operations must be profitable appears to be generally recognized by most employees; in fact, when asked what per cent profit the railroads should make on the money invested in them, only 8 per cent of all employees (8 per cent m. of w. & s.) said 5 per cent or less; 33 per cent of all employees (37 per cent m. of w. & s.) said they should earn between 6 and 10 per cent; 13 per cent of all employes (12 per cent m. of w. & s.) said between 11 and 24 per cent; 11 per cent of all employees (8 per cent m. of w. & s.) said between 25 and 49 per cent; and even a few of the employees questioned suggested a return as high as 50 to 75 per cent. The median of these profit suggestions was a 10 per cent return on investment—a figure that would be the delight of any railroad, even in years of prosperity.

But, unfortunately, more than one-third of those questioned in this survey dared not even hazard a guess as to the profits the railroads actually made during the last year (1944), and most of those who did venture an estimate were not even reasonably correct in their answers—a substantial number giving figures of excessive proportions, in some cases higher than 75 per cent. The median of all estimates was 27 per cent.

Specifically, 4 per cent of all employees (4 per cent m. of w. & s.) estimated 5 per cent or less profits; 26 per cent of all employees (29 per cent m. of w. & s.) estimated from 6 to 24 per cent profits; 16 per cent of all employees (12 per cent m. of w. & s.) estimated from 25 to 49 per cent profits; and 18 per cent of all employees (13 per cent m. of w. & s.) estimated profits in excess of 50 per cent—some in excess of 75 per cent. Some measure of ignorance with respect to the true profits earned by the railways could be a blessing to those possessing it, in stimulating a sense of well-being and security among them, but all too often its effect is just the opposite, and a seriously disturbing element to the railroads in their relations with both employees and the public.

(Continued on next page)

Further striking evidence of the employee's ignorance of the true status of railway profits is revealed in the fact that most employees said that even during the last 15 years, including the lean depression years, the railroads made a sizeable profit on the money invested in them—only 8 per cent indicating that the roads may have lost money.

Thus, on the one hand, employees as a whole appear generous in what they think the railroads should earn (median 10 per cent) but, at the same time, think the roads earned more than two and one-half times that amount in 1944 (median 27 per cent), and that they even earned substantial profits during the depression years. But what are the facts?

The annual report of the Interstate Commerce Commission for 1945 shows that 1944 net income (i.e., after taxes and interest) was 7.76 per cent of stock, and that actual dividends were 3.09 per cent of stock. Net railway operating income (i.e., after taxes but before payment of interest) was 4.18 per cent of the investment in railroad property and net income was 7.77 per cent of gross revenues. Whichever one of these ratios is taken as the measure of railroad "profit," it is evident that the rate, even in such a relatively prosperous year as 1944, was far lower than the median of 27 per cent set by the employees questioned as to the size of the owner's share in railroad earnings.

And as for the earnings of the railroads during the depression years, the Interstate Commerce Commission's annual reports list the net income available to railroad stockholders at the following percentages to stock outstanding during the years 1930 to 1939, inclusive:

Year	Per Cent Net Income to Stock	Year	Per Cent Net Income to Stock
1930	5.77	1935	0.53
1931	1.69	1936	2.23
1932	Deficit	1937	1.49
1933	0.26	1938	Deficit
1934	0.23	1939	1.44

The I.C.C. annual reports further reveal that the following percentages of outstanding railroad stock have received no dividends whatever in the last 15 years:

Year	Per Cent of Stock Receiving No Dividends	Year	Per Cent of Stock Receiving No Dividends
1930	23.07	1938	67.93
1931	26.80	1939	67.36
1932	67.15	1940	61.71
1933	68.89	1941	59.35
1934	65.74	1942	43.63
1935	65.61	1943	42.03
1936	63.80	1944	41.54
1937	60.36		

A 27 per cent return on investment in 1944? No, that was the median of estimates of all employees questioned who, along with a substantial part of the public in general also think, no doubt, that railway profits are today well above the 20-per cent level. Maybe such an erroneous understanding of the facts has been an underlying factor in many employee-management disagreements; one of the reasons why the railroads are the target of politicians and assessors in the case of nearly all public and quasi-public improvements, while competing forms of transportation are less burdened; and at least one of the considerations behind the high and inequitable taxation foisted on the railways compared with other forms of transportation.

Yes, employees are correct that the railways must earn a profit, and a sufficient profit to enable them to attract the needed capital for continued improvements in equipment and fixed properties. And every employee, in his own selfish interest, should foster every means to that end. If the railroads cannot or are not permitted to make such a profit, then their employees may well be concerned about the future. Then, what 42 per cent of railway employees fear, as indicated by this survey—hard times for the railways and their employees—will not be in the offing—it will be at hand.

Ties—

Small Matters May Mean Much in the End

IT is a fact that can be confirmed by observing the work of many gangs that, despite all that has been said on the subject, trackmen, and even supervisory officers, do not yet appreciate fully that the manner in which they install ties may have an important bearing on their ultimate life. The installation of a tie does not consist merely of inserting it into the track and of then spiking it in place, later to be tamped to a solid bearing. On the contrary there are a number of items that enter into its correct installation, and the eventual service that will be obtained from a tie will depend on the things that may be done or left undone when it is installed.

Perhaps the most important item in conserving the life of ties, especially those that are given preservative treatment, is the practice of adzing and boring them prior to treatment. Yet, annually, about 7 per cent of the ties that are inserted are adzed without being bored or are bored without being adzed, while from 25 to 30 per cent of the ties treated are neither pre-adzed nor pre-bored. Thus, from 30 to 35 per cent of the ties that are inserted in the track annually are started in service under a severe handicap so far as the length of their prospective service life is concerned. Obviously, this form of neglect cannot be laid at the door of the trackman or at that of his supervisory officers, yet it is a poor example for management to set before the men to whom it must look for the best and most economical practices in maintenance.

Every gang that is engaged in inserting ties should be equipped with tie tongs, and supervisory officers should insist that they be used, instead of picks and shovels, for dragging the ties into place, since much damage, definitely shortening tie life, results from the use of the latter tools. Likewise, the striking of the ties on the ends or sides by spike mauls or sledges, when centering, straightening or spacing them, should never be permitted.

Another form of initial damage results from failure to see that the spike holes in the tie plates register with the prebored holes in the ties. Much damage to the wood fibre can be avoided by giving the little attention that is necessary to insure complete register. Likewise, poor spiking is detrimental to tie life. The spikes should be set perpendicular to the tie plate and driven vertically into the pre-bored holes. Otherwise, the wood will be damaged sufficiently to permit early decay in this area.

Some of these items may seem to be more or less inconsequential. Yet they all have a very definite effect on the service that will be obtained from the tie and, therefore, upon the cost per year of the tie. Many a tie that should have lasted 25 years has been removed after 15 or 16 years because of initial damage it received at the time of insertion, as a result of carelessness or neglect to take the precautions and to use the care that should have been exercised. Most roads have rules or instructions covering all of the points that have been mentioned, and others, yet one need only to watch almost any gang engaged in renewing ties to find that they are not being enforced or that the enforcement is lax and without enthusiasm.

Spot Tampers—

A Trend in Mechanization

A MOVEMENT that has been in evidence for several years without attracting a great deal of attention, which bids fair to become sufficiently widespread to set another milestone on the road toward mechanization of the maintenance forces, is that of equipping section gangs with spot tampers. Quite naturally, only gangs employed on main lines have been equipped so far, and, generally, only those that are working in stone or crushed-slag ballast.

At least until all sections on important traffic lines are equipped with power tampers, there seems to be no particular advantage in diverting this equipment to lines of light traffic or for use with light ballast, such as cinders, chatts or gravel of the quality usually provided for less important lines. For these lines and these ballast materials, hand tools give reasonably satisfactory results for the class of service that is operated over them.

Observation indicates, and experience has confirmed this, that it is desirable to equip section gangs on main lines of heavy traffic and high-speed trains with power tampers of the self-contained one or two-unit types. It is conceded that they do better work than can be done with hand tools; the work is more uniform and the tracks stands up longer in service; less time is required to do the tamping than with picks; it is not necessary to clean out the cribs to reach the bottoms of the ties; and the track rides better under high-speed trains.

Those who have equipped some or all of their sections with these tampers are almost unanimous in their belief that every section on high-speed, heavy-traffic lines should be equipped with at least two unit tampers, and more if the size of the gang warrants. A gang consisting of a foreman and three laborers can use two of the tampers for spot work, and many supervisors have found that by doubling up neighboring sections they can even do a considerable amount of general surfacing. Numerous maintenance officers have reported an increase in the output of section gangs amounting to 25 to 50 per cent after they have been equipped with power tampers.

Some maintenance officers who have already equipped some of their sections with power tampers are planning to extend the practice over all of their main lines. It may be to the advantage of those who have not yet done so to give consideration to this subject. Few officers are now willing to discuss the assignment of such equipment to sections on branch lines until they have had more experience with it on main lines. This attitude, however, is based on economic considerations and not on the physical advantages of using the equipment.

Erosion Control—

Is Wider Application Justified?

THE erosion of slopes in both cuts and on embankments is a source of considerable expense to the railroads. In cuts this action causes the side ditches to become filled with material that must be removed periodically if efficient drainage is to be maintained, while on embankments the wearing away of the side slopes has a weakening effect that must eventually be corrected. In extreme cases the damage may be sufficiently extensive as to weaken the roadbed seriously or to obstruct traffic by reason of material deposited on the track.

Various roads have for many years interested themselves in the problem of erosion control, with the result that a number of effective methods of achieving this end have been developed. The use of vegetation, either in the form of sod or of direct plantings, to hold the soil in place and to reduce the rate of run-off, is one of these. Another, of more recent introduction, involves the use of a protective blanket of cinders or other suitable material. In both instances berm ditches may be used in cuts, possibly in conjunction with flumes down the slopes, to minimize the volume of water passing over them during rain storms. Right-of-way grading, a practice of still more recent introduction, also has as one of its objectives the flattening of the slopes to retard run-off and erosion.

Experience has shown that these measures, when properly applied, are effective in protecting side slopes from erosion. Even so, it is a common sight today to see slopes that are entirely without protection of any kind, many of them showing the effects of serious erosion. The truth seems to be that on most roads measures for protecting slopes against erosion are applied only at the points of worst damage, rather than as a regular practice wherever erosion is an important factor in causing excessive ditching and bank-maintenance costs.

The railroads generally now seem to be entering a period that will be characterized by higher costs for both materials and labor, placing maintenance men under greater pressure than ever before to keep costs under control. Since the demand will be urgent for investigating every possibility for achieving economies, it seems appropriate to suggest that one such possibility is afforded by the advantages to be obtained through wider application of the means available for controlling erosion. In any event, a comparison of the cost of effective protection with the expenses, both direct and indirect, that are occasioned by erosion, might, in individual instances, produce some enlightening results.

Color Dynamics—

An Aid...

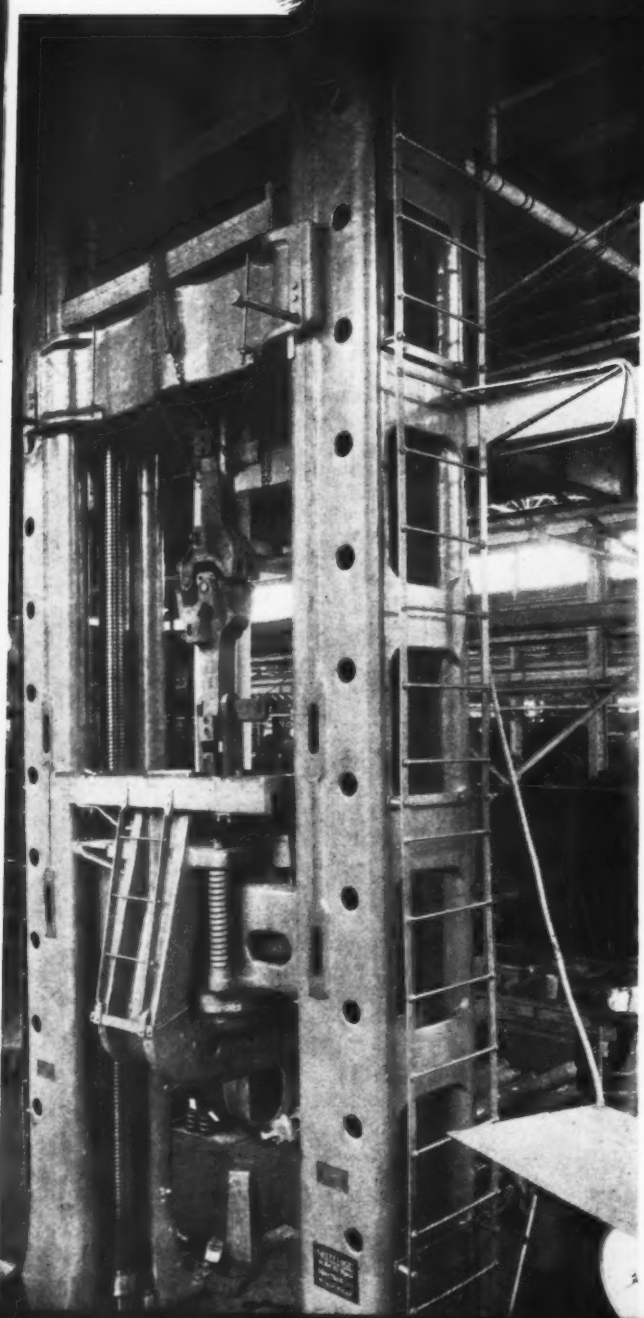
surroundings
...ors can also be used, it
...s out, to stimulate employees to
greater diligence with less fatigue, and
to convey the need of caution.

PAINT is the oldest and most widely used material for protective and decorative purposes, but only recently has it been determined that the proper blending of colors, termed "color science," will increase production, reduce personal injuries, provide better working conditions and improve morale. Since every color has a definite wave length or light reflection value, color science can be used not only to produce a pleasing contrast, but also to enhance the quality of light. In waiting rooms, for instance, the ticket offices or other facilities are usually built along one wall and instantly become prominent and eye-catching if painted a color different from the adjacent wall. If this color is one that will blend or complement other colors, a psychological effect results which reduces nervous tension and imparts a feeling of relaxation and cheerfulness. For rest rooms, bright, harmonizing colors are not only cheerful and restful but also are sanitary and react on the average individual by making him more careful and interested in maintaining cleanliness.

Color can either stimulate or depress; it can focus attention upon an object, cause it to recede, or to blend with the surrounding colors. It can be used to emphasize safety or to induce cheerfulness. Trucks, used for loading and unloading express, stand out prominently if painted focal yellow and striped in black. The painting of traffic lanes will aid in reducing congestion on platforms and elsewhere. Doors stand out clearly when painted in colors. The advantages of color variation are innumerable.

It is difficult to describe the pleasing effects produced by contrasts of color unless done visibly. Many different

*Presented before the annual meeting of the American Railway Engineering Association in Chicago on March 12, by a subcommittee of the Committee on Buildings, of which Mr. C. M. Angel, engineer of tests, Chesapeake & Ohio, was chairman.



In the Interest of Safety, the Crossheads on This Huge Testing Machine Were Painted a Focal Yellow and the Body Was Painted Vista Green as a Contrasting Background

color arrangements are recommended for various types of work, and, for this reason, no rule can be set up which will apply to every location. Each problem must be worked out to suit the individual case, using colors which will provide a distinct color difference between working and surrounding areas, and light colors at proper locations to achieve brightness without extreme glare.

Different Colors

Colors used in this type of painting may vary in shades, depending on the manufacturers' specifications. However, the colors generally used are ivory, buff, green, gray, vista green, blue, yellow, beige, red, orange, dark gray, cascade blue, sea-foam green, sand, suntone, rose tan, stratosphere gray, eye-rest green, cruiser gray, dixie gray, pewter gray, tile red, light oak, dark oak, white, yellow and orange.

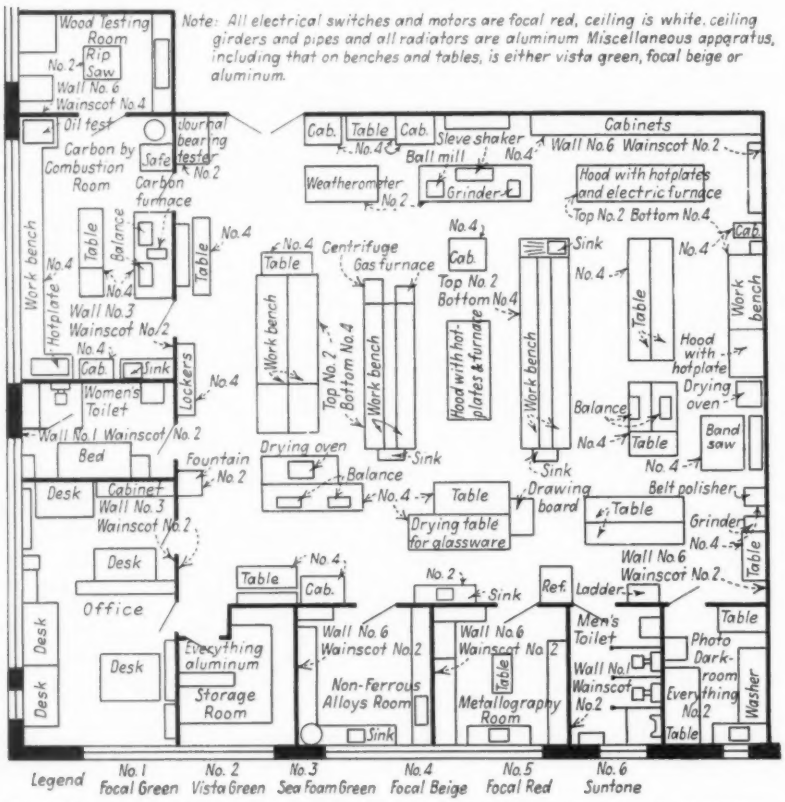
Of the colors listed, those embracing ivory to dark gray, inclusive, should be considered for machinery and equipment; the range from cascade blue to eye-rest green, inclusive, for walls and ceilings; cruiser gray to dark oak, inclusive, for floors and dados; and white to orange, inclusive, for zone marking.

Before undertaking to apply any color scheme in the painting or repainting of a station, shop or other facility, those responsible for the selection of the paint should confer with a paint manufacturer's representative who is well informed regarding the blending of the various colors. They should also give consideration to the type of work performed in the building, as well as to the characteristics of the personnel employed. It has been demonstrated that greens, browns, blues, and such other colors are preferred in shops employing a preponderance of men, but that more delicate shades, such as turquoise and peach, are desirable where women are employed.

A good general plan to be followed in the selection of colors is to paint critical parts with a color that stands out visibly, while painting other parts in blending colors which will serve as a background and lend contrast to the critical parts. Colors selected for walls should reflect as much light as possible, without subjecting the workers to harsh changes in brightness, and should blend with the wainscoating. In ceiling painting, where a large amount of steelwork or pipes are vis-

Partial View of Chemical Laboratory—Brightness Is Obtained Without Glare by Color Painting with Light-Reflecting Paints

ible, blue or similar colors are suggested as these colors seem to make the ceiling recede. If the ceiling, pipes or steelwork are high over the workers' heads, consideration can be given to a white ceiling and to aluminum for the pipe and steelwork. It is always best to use red to designate electrical conduit, switch boxes and similar equipment.



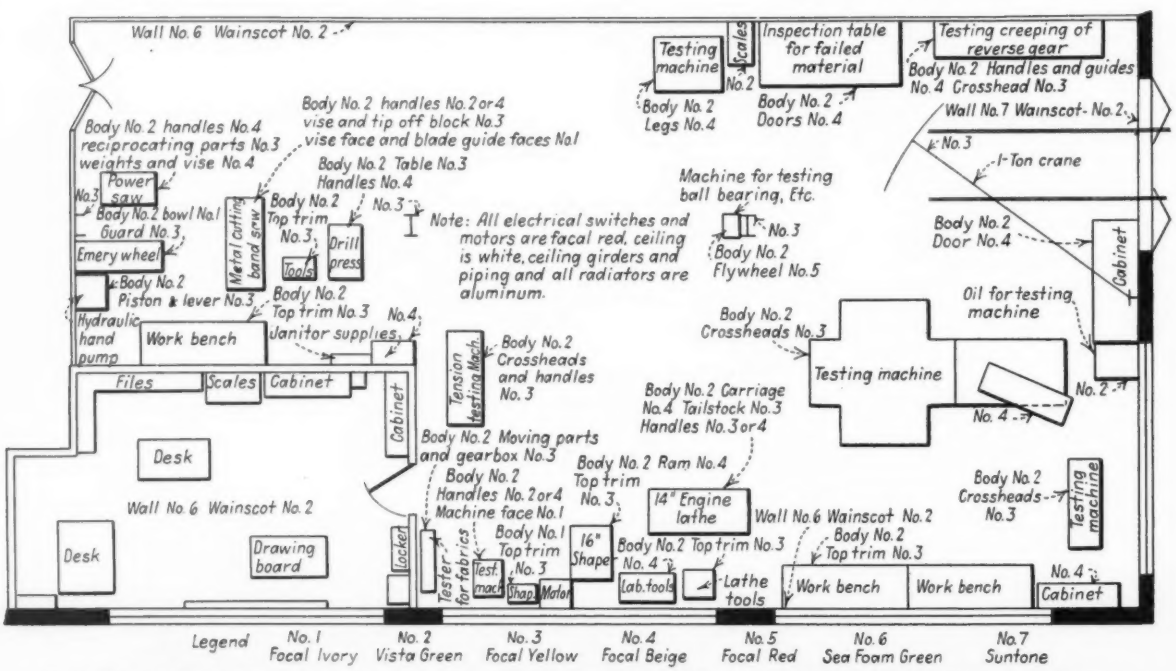
Floor Plan of Chemical Laboratory, Test Department, Chesapeake & Ohio, Huntington, W. Va., Showing Color Painting Design for Apparatus and Interior

When there is some doubt as to how colors will harmonize, a check can be made with a rough model. A box, about 12 in. by 18 in. in size, can be built of wallboard or like material, with one side open and the interior painted with the selected colors. The top will represent the ceiling, the back and ends the walls, and the bottom the floor. When the painting is completed and the dado stripes have been applied, the result can be viewed to ascertain how the colors harmonize. A better plan might be to cut pieces of board to represent the ceiling, walls and floors, which can be placed in the box. These boards can be painted with various colors, so that different arrangements may be tested until the desired color scheme is found. A small block of wood, representing a machine, can be cut to scale and painted, and set on the floor of the box to ascertain how it blends in with the walls, ceiling and floor.

Light Reflection

One of the primary objectives of painting walls and ceilings is to reflect light in which to work. Consequently, it is of value to consider the light reflection values of the various colors when making a selection to harmonize with the color scheme. The generally accepted light reflection values are tabulated on the next page.

The light reflection value of colors is very important in view of the fact that (1) daylight illumination diminishes sharply from 90 foot-candles at



Floor Plan of Physical Laboratory at Huntington, Showing Distinctive Color Scheme for Machines, Equipment and Interior

the window of a typical room to about 5 foot-candles at the inner wall; (2) a dark ceiling absorbs light and causes shadows to fall from machines located near windows; and (3) a white ceiling reflects light, thus reducing the shadows to a minimum.

After the colors have been selected the surface texture should be considered; that is, whether a flat, semi-gloss, or high gloss paint should be used. The semi-gloss and high-gloss paints will stay clean longer because they will not collect dust as fast as a flat or rough surface.

Determination of color harmony will always be based upon individual taste unless the opinion of a color expert is to be considered.

Application in Laboratory

As a practical example of the application of color painting, the following account is given of the repainting of a railroad physical and chemical testing laboratory. The laboratory had been painted to a standard plan with the machines gray and the walls, window frames and steelwork a flat, non-reflecting paint. The work benches and tables in the chemical laboratory were finished in dark oak and had been varnished. Since this style of painting was low in light-reflecting qualities, the laboratories always had a dark, gloomy appearance and gave the impression of a perpetually cloudy day.

Light Reflection Values

Color	Per Cent of Light Reflection
White	89
Light yellow	78
Ivory	78
Light cream	77
Peach	72
Rose	66
Pale green	62
Light blue	62
Cream gray	61
Light gray	57
Buff	55
Aluminum	42

When it was decided to repaint these facilities, attention was given to color painting, not only to brighten the surrounding working areas, but also to provide a psychological benefit to the workmen. It is an established fact that proper colors give people a "lift," whereas wrong colors have a disturbing effect.

An investigation was made to secure the most desirable colors for laboratory work which, at the same time, would harmonize with the building construction. As a result, certain colors were selected to separate the walls and ceiling, and the critical from the noncritical parts of test machines, and to produce the most desirable effect in both daylight and artificial light.

Through the Proper Choice of Colors for Waiting Rooms a Feeling of Cheerfulness or Relaxation Can Be Imparted, or Other Desired Effects Can Be Obtained

Although color illustrations would more effectively demonstrate what was accomplished in painting these laboratories, the floor plans accompanying this report will show what was done.

Painting of Old Facilities

To do a first-class color modernizing job, everything must be arranged in an orderly manner and anything that tends to clutter up the facility and give the impression of disorder should be removed or streamlined as much as possible. Such a procedure is not always practicable in old railroad facilities, as their construction and layout may lend themselves to little streamlining. In such cases, all that can be done is to paint machines, walls, lockers floors, etc., with colors which will be helpful in brightening up the area to give fair light reflection without glare, and make the critical parts stand out, thus affording as much safety protection as possible.

Color painting results in innumerable benefits by increasing production, reducing injuries, providing better working conditions, and uplifting the morale of the workers.

Many different color arrangements are recommended for various types of work, and for this reason no rule can apply to every problem.

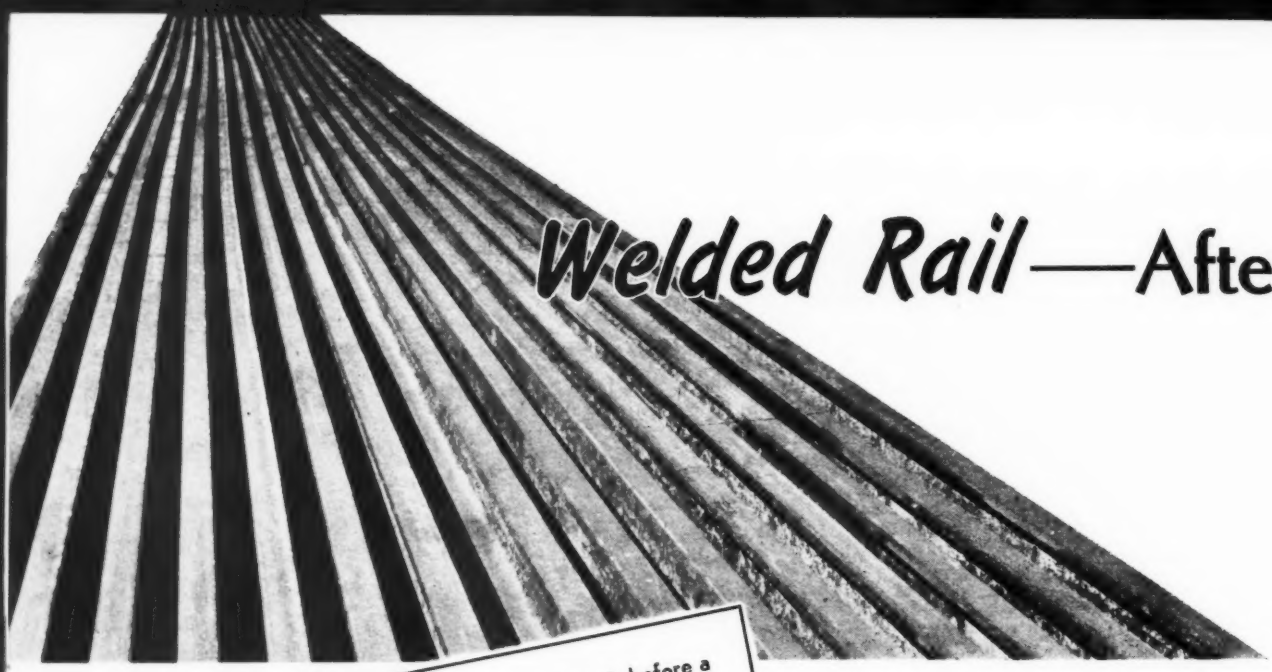
To secure the best color scheme, an expert should be consulted as to proper blending or matching; however, the final selection will usually be made by the person or persons in charge of the work, who will exercise their individual preferences or tastes.

Consider Proper Light

The light reflection values of various colors should be considered when making a selection so that proper light accompanies the color arrangement.

Streamlining is preferred in color painting. However, such painting can be used on old facilities with proper study.

This mode of painting has been used successfully in industrial plants for a considerable period of time and, to parallel this success in other industries, the railroads must realize that dark, drab and somber painting is obsolete, and must step forward into the color painting field.



Welded Rail—After

This article, which reports an address by Mr. Ferris before a recent meeting of the New England Railway Club, contains a detailed analysis of the experience of the D.&H. with both welded and angle-barred track construction, citing the opinions of both track supervisors and division engineers, as well as those of the author. With 11 separate installations of welded track under observation, involving a total of 10,984 welds, some of which were made as early as 1933, the facts pointed out herein are of more than ordinary interest for the implications contained in them.

HEAVIER motive power pulling more heavily loaded cars at higher speeds, requires greater refinement in track line and surface than ever before. The effect of small irregularities is magnified as the speed increases. To maintain such line and surface so necessary now and for the future, the track must be maintained to a higher standard than heretofore, and this can be done only by increasing maintenance expenditures, unless rail joints are considerably improved, the number of them is reduced, or they are eliminated entirely.

Our first standard joint for 80-lb. and 90-lb. rail on the D. & H. was a 30-in., 6-hole head-contact angle bar. This was replaced with a 4-hole, 24-in. angle bar of both the head-contact and head-free types for 90-lb. rail. We experimented with 3-hole angle bar, 14 in. long, with 90-lb. mitred rail. The two-hole Pascal joint, 10 in. and 12 in. long, with a base plate, was also tested. With the first installations of 130-lb. rail, a 24-in., 4-hole angle bar was used, similar to that used with the 90-lb rail. The advent of the M & L spring-steel rail clip produced the use of the 18-in. Neafie bar with a 24-in. joint plate, spanning two joint ties, to permit the clipping of the rail at the joint.

It is fair to question here why we changed from long bars to short bars. The Fifth Progress Report of the A.R.E.A. Special Committee on Stresses in Track, under the title: "Miscellaneous Features of Rail Joints," said, in part, as follows: "Tests show that in a joint bar 24 or 27 in. long, almost the entire part of the bending movement is developed within six or eight inches of the middle of its length, and that generally there will be little load bearing contact outside of a length of bar of 20 in. The longer length of bar seems to give some reduction in the vertical movement at the ends of the bar (but not at the rail ends) upon application of load for bars having the same general qualities of fit. Except for this, there is no advantage in the greater length of bar apparent from the tests, and it may be said that the metal in the greater length may well be used in making a heavier section of bar." This appears very reasonable, and at least worthy of trying, when economies seem so apparent, but our experience with short bars has not been satisfactory.

In 1939, when we first installed 112-lb. rail, we standardized on a 36-in., 6-hole, toeless bar. Because of what we did in this regard, I am pleased with the recent conclusions of the Committee on Rail in its study of service tests of various types of joint bars, which state that the test installations definitely indicate that a longer service life may be expected from the 36-in. bars than from the 24-inch bars; also, that the relative performance of long-toe bars compared with that of the near symmetrical types of short-toe bars is good, but is not considered superior.

The conclusions of the committee also indicated, for one test, that, outside of the joint, or 20 in. from the rail end, the rail wear was so insignificant for 108,600,000 gross tons of traffic that the rail on tangent track would appear to last almost indefinitely, unless damaged.

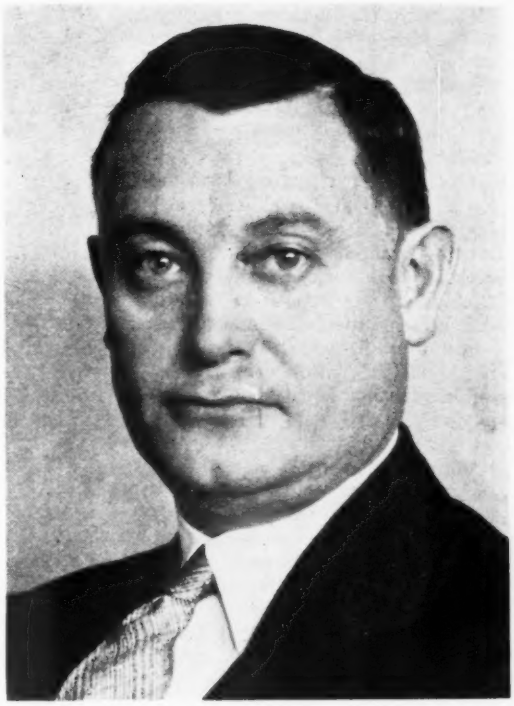
Batter Causes Trouble

All track maintenance men know that batter is the forerunner of many joint ailments and undesirable track conditions in general, and that, as long as there is the slightest opening at the rail ends, batter cannot be entirely prevented. This prevails regardless of the type of joint, weight of rail or end hardening. It is apparent, therefore, that the joint fastening and the ends of rail need the most improvement. However, considering the life we are now obtaining from our rail ends, and the expense of procuring such life, there seems to be little justification in improving the wearing qualities of the remainder of the rail for tangent track.

The joint is expensive in first cost and expensive to maintain. Our 6-hole, 112-lb. joint assembly installed, including bonding, costs roughly $5.60. Maintenance of joints is governed by many conditions, such as

13 Years on the Delaware & Hudson

By P. O. FERRIS
Chief Engineer
Delaware & Hudson, Albany, N.Y.



type of fastenings, condition of subgrade, kind of ballast, weight of rail, speed of trains, axle loads, gross tons of traffic and efficiency of labor. I believe, generally, that at least one complete renewal of joint fastenings can be expected in the life of rail. In addition, throughout the life of the rail there is the expense of joint slotting, reconditioning of rail ends by welding one or more times, and the tightening of track bolts at least once a year, with some renewals of bolts and spring washers. It is possible also that bars may have to be reformed or bar shims applied. Joint ties have considerably less life than intermediate ties and, unquestionably, there is the additional maintenance expense of surfacing, lining and gaging because of the joint.

Roughly, considering the life of 131-lb. rail at 300,000,000 gross tons of traffic and joint-bar life at one-half the life of the rail, or 150,000,000 gross tons of traffic, the cost of the joint per million gross tons of traffic per mile may be as given in the accompanying tabulation.

Cost of Joint per Million Gross Tons of Traffic per Mile

For the joint fastening	$8.74
Original rail-end hardening	.34
Total	$9.08
or	
For the joint fastening	$ 8.74
Rail-end welding once in the life of the rail at	1.30
Total	$10.04

This is a cost worthy of our serious consideration, especially when there is still the annual expense of bolt tightening, together with the occasional replacement of failed parts.

Our charges to Account 220 (Track Laying and Surfacing) for the war years 1940-1945, inclusive, averaged 23.3 per cent of all maintenance-of-way expenditures, and for the immediate six years prior thereto (depression years) 18.7 per cent. Charges to this same account for the war years above mentioned were 66.4 per cent of total charges to track labor accounts, including Account 272, and for the six depression years, 57 per cent. This is the largest and most important account, and the one most immediately responsive to fluctuations in traffic, as the percentages indicate.

The A.R.E.A. Committee on Economics of Railway Labor has figured that 45 per cent of track labor was necessary to keep rail joints in proper line and surface. If this is true, and I believe it is conservative, one can readily see the possibilities of the large savings to be effected through the improvement or elimination of rail joints.

Welded Rail Installed

Much has been done in the last 15 years toward the elimination of joints by welding rails together into long lengths. The A.R.E.A. Committee on Continuous Welding of Rail lists 14 separate railroads with one or more installations of various lengths. Seven separate welding processes have been used, involving the welding of 5,212 joints in tunnels and 17,735 joints in open track, or a total of 22,947 joints. Weld failures recorded have numbered 330 in tunnels and 163 in open track, or a total of 493. This amounts to slightly more than two per cent of the total welds.

Seventy-eight per cent of the welded rail is in open track and it is interesting to note that weld failures of this rail have been less than one per cent. It is the open-track welding of rail in which we are all interested for general practice.

Welded rail weighing from 100 lb. to 131 lb. has been laid under all conceivable conditions. All types of ballast have been used, from locomotive cinders to crushed stone. Grades have been as high as 1.32 per cent and curves as high as 7 deg. Installations have been on single track with traffic in both directions and on double track where traffic is directional. Various types of anchorages have been used, from the orthodox cut-spike and anti-creeper to lag screws and spring-steel clips. It has been laid where temperatures range from minus 30 deg. to plus 120 deg. Wheel loads are as high as 37,000 lb. and speeds reach 70 m.p.h. Annual tonnage during the war has exceeded 38,000,000 over some of the welded installations, while some locations, since the rail has been in service, have carried over 200,000,000 gross tons of traffic. It is evident that continuous welded rail is definitely undergoing a practical test.

On the D. & H.

On the D. & H. we have 11 separate installations, involving 3,707 thermit welds and 7,277 flash welds, or a total of 10,984 welds—approximately 43 track-miles. I believe this to be the greatest mileage of continu-

ous welded rail on any railroad in this country. It is laid under all such conditions as I have mentioned previously, with the one exception that all of our welded rail is fastened with M & L spring-steel clips. Installations were made in each of the years 1933 to 1937, inclusive, and also in 1939.

We have now had almost 13 years of experience with welded rail. Out of 10,984 welds, we have had only 88 failures, and 7 of these were by reason of a derailed car with a broken wheel. This represents, roughly, 0.8 per cent of all of the welds installed. Of the 7,277 flash welds, there have been only 5 failures—a remarkable record. Some have carried over 200,000,000 gross tons of traffic at speeds as high as 60 m.p.h. It is natural that most of the failures would occur in the thermit welds for the pioneering was done with thermit welds on an experimental basis; experiments not only to determine if butt welding was practicable but, as well, to determine what was a satisfactory welded joint. A very satisfactory thermit weld has been developed.

All of our division engineers and most of our track supervisors have had experience with the maintenance of welded rail. I asked each one to write to me, giving in detail the relative merits of welded track compared with jointed track, and their recommendations as to further installations of continuous welded rail. Replies received were lengthy and unusually interesting, and the following are a few extracts from some of them:

(1) "After maintaining welded track for several years, I find maintenance is far less than that required for jointed track. Welded track holds good surface and line and there are no battered joints. In seven years, the only work necessary on welded track in my territory has been the renewal of ties. In my opinion, no work should be done on welded track during hot weather. I find that the less work done in mid-summer, the less trouble there will be. I would recommend further installations."

(2) "I think reports will show that it has taken less than half the labor for maintenance (of welded track) compared with jointed track. I would recommend further installations where the roadbed is so good that the track will need little disturbance from surfacing or lining when the weather is too hot or too cold."

(3) "There is some risk attached to working on welded track during hot weather. If welded rail was always laid in extremely warm weather, there would be no danger of the track kicking out when raising track or renewing ties. I would not recommend further installations except through station platforms and crossings."

(4) "Maintenance of surface and line is much less than on jointed track and riding qualities are greatly improved. Periods during which work on surface and line can be attempted are limited, since it is not good practice to raise welded track when the temperature is above 70 deg. Contraction in cold weather subjects the joints at the ends of welded stretches to severe strains. When they open up, it is sometimes necessary to close up by bucking. The cutting in of rail when welds fail takes too much time and is costly. The disadvantages of welded rail could be eliminated by the use of shorter lengths, say not over 500 ft. The additional joints would

Above — Unloading a Length of Continuous Welded Rail on the D. & H. Left—One of the 11 Installations of Welded Rail on this Road

not materially increase maintenance costs and would permit working of the track safely in hot weather."

Limit Length

(5) "Welded rail provides a smoother riding track; eliminates the cost of joint fastenings; accounts for savings in maintenance due to the elimination of joint surfacing and the spacing of joint ties. Due to unseasonal weather in my territory, where practically all surfacing and tie renewals must be done in warm weather, welded rail cannot be worked without risk of buckling. I recommend that welded rail be confined to 20 rail lengths and that we dispense with clip fastenings, using spikes and anti-creepers, anchoring in both directions."

(6) "The only advantages I can see are less joints to maintain. The welded rail on the hill has been a source of hardship ever since it was first installed due to the fact that it is laid in cinder ballast with narrow shoulders, and it is almost impossible to keep in line. It has a tendency to kick out on the curves on hot days and to move back at night when it cools. It must be watched constantly. General surfacing and lining can be done only when it is cool. I would not recommend laying welded rail in tracks on heavy grades without providing necessary expansion joints. If given the choice, I would never lay welded rail on cinder-ballasted track or in locations where many curves exceed three degrees.

"In spite of what I have said against the use of welded rail, the fact remains that properly constructed and maintained welded track makes a beautiful piece of railroad and, if installed in a location where there is a heavy and well-paying passenger traffic, the picture is changed completely, because I believe the welded track would draw increased business."

(7) "Maintenance of welded track differs from jointed track. Track must be kept full and a wide shoulder preserved. The 'no stress' temperature of approximately 90 deg. F. must be maintained and the clip pressure preserved. When a weld fails and a closure rail is installed, the length of the closure rail must be exactly the same length as the piece removed. To secure this during cold weather, the temperature of that length of rail that has moved through the clips must be raised by slow burning oil to effect the proper expansion. Experience has shown that the expansion opening caused by a break has not exceeded 2¾ in. and that movement through the clips has been confined to 250 ft., more or less. Closure joints should be made with 6-hole bars. No bolt failures have been experienced with 6-hole joints. Welded rail laid and maintained at no-stress temperature presents no undue difficulties when surfacing and lining in hot weather. The maintenance advantages of welded track are so great that further installations are recommended."

From Division Engineers

(1) "Objections cited in the attached letters are isolated instances and I do not think apply generally. I am much in favor of the welded construction because of the elimination of joints and the subsequent maintenance, and also because it results in better and smoother riding track. I feel that the long stretches should be reduced to not exceed ¼ mile in length. Extreme care is necessary in warm weather in handling repairs on welded track. I think this could be eliminated if shorter stretches were adopted. I also think the use of cut spikes and rail anchors, instead of clips, might result in less maintenance cost."

(2) "There is a wide difference of opinion between supervisors relative to the merits of welded track. On the hill, the welded track got out of position due to the extension of the passing track and, again, by clips being broken in a derailment. For the heavier traffic, such as experienced during the war, I believe welded rail should be installed only where curvature is not in excess of 2 deg. On heavy grades, clips should be replaced with rail anchors, due to the fact that the clip holding edges become rounded due to wear, and they are affected adversely by brine drippings.

"I would recommend welded rail to eliminate the rail joint, which is the weakest part of the track structure. With this eliminated, we do away with all the maintenance problems that surround it: that is, irregular expansion, loose and broken bolts and lock washers, battered and chipped rail ends, surface-bent rail, pumping joint ties, churning ballast and excessive mechanical damage to joint ties. At the same time tie spacing at the joint is eliminated and track surfacing is materially reduced.

Failures Explained

"The engineer of track reports that failures of welded joints have occurred generally in the earlier installations, when welded joints were under development. Failure of joints at the ends of welded stretches were due to poor drilling of bolt holes, permitting all of the stress to be taken at times by one or two bolts. No further trouble has been experienced since this has been corrected and 6-hole joints have been applied.

"Investigations of rail kicking out of line have developed that the rail involved was laid at low temperatures. The loosening of the clips on a hot day, permitting the rail to expand, corrected the condition and no further trouble has been experienced.

"The rail on the hill was laid in the late fall when temperatures were unusually low. It is my feeling that this rail was never permitted to run out fully to eliminate compressive stresses. Further, this rail is subject to considerable creepage under downhill traffic, resulting in bunching in certain locations. Analysis some time ago of all our welded installations revealed no trouble whatsoever from buckling where the rail was installed at temperatures of over 60 deg.

"As to the surfacing and lining of welded track, it is my observation that no difficulty occurs when the work is done at the temperature at which the rail was laid or at lower temperatures. It is not desirable to work welded rail when it is in compression. In other words, difficulties experienced with welded rail have either been due to improper practices or have been of a nature which can be taken care of under proper methods of handling."

The foregoing are the opinions of men who have been, and still are, responsible for the maintenance of welded rail on the D. & H. Management, however, is interested in safe operation and in costs. Reports of all welded installations in this country indicate, without question, that satisfactory welded joints can be made, and in quantities, at a reasonable cost. The prices of welded joints, installed, range from $9.50 to $29, depending on the type of weld and quantity. Since almost 15 years of experience in this country, and many more years abroad prove conclusively that satisfactory welds can be made, what we want to know is this: Is continuous welded rail economical?

Test Sections

On the D. & H. we have endeavored to determine the economy of continuous welded track compared to jointed track, and for that reason we started two test sections under as nearly identical physical conditions as it was possible for us to make them:

One section comprises 11.2 miles of 131-lb. welded construction and 11.2 miles of jointed construction. The tracks are parallel, the ballast is crushed stone, and the traffic is direc-

tional. On this section, there are 7.19 miles of tangent track and 4.01 miles of curved track. The maximum curvature is 4 deg. and the grade is 0.88 per cent. This section has now been under test eight years.

The other section is on single track, the ballast is partly locomotive cinders and partly ore tailings. Of welded track in this section, there are 3.84 miles of tangent track and 4.06 miles of curved track. The maximum curvature is 7 deg. and the maximum grade is 0.64 per cent. The jointed track is similarly ballasted, and includes 6.19 miles of tangent track and 7.64 miles of curved track. The maximum curvature is 7 deg. and the maximum grade is 0.6 per cent. This section has been under test seven years.

Results Tabulated

Careful records of man-hours have been kept for every item of maintenance comparable to both types of construction, which are summarized in the accompanying table on a per mile per year basis and on a per million gross tons per mile per year basis.

From this table it will be noted there is a saving in lining and surfacing from 31 to 46 per cent, and in gaging from 33 to 95 per cent; furthermore, that since the installations were made, the gross tons of traffic over the jointed track in both tests are more than that over the welded track. The single-track test section affords a better comparison because the annual tonnage and speed of trains are identical for both types of construction.

Now, let us analyze this a little more fully as to economies. The installation of welded track will cost from $1,500 to $2,000 per mile more than jointed track, depending on the type of weld, quantity of welds, and type of joint fastening. On the basis of our Port Henry test for a period of seven years, there is an annual labor saving in maintenance per mile of, roughly, 30 per cent for the particular items tabulated. No material costs are included in the saving.

There are prospects of further economies in favor of welded construction in both materials and labor, as mentioned previously. It may be necessary during the life of the jointed rail to renew the joints or, at least, to reform the bars, and reconditioning of the rail ends by welding may be necessary, at costs amounting to $9 to $10 per million gross tons per mile. In addition, there may be some renewal of joint ties, and the rail itself may need replacement, with both the material and labor costs attending such renewals. The tests must be continued to determine what the future may bring forth.

However, our experience to date with continuous-welded rail has taught us the following: (1) A sound practicable welded joint can be made. (2) Welded rail in long lengths can be readily transported and installed. (3) In our climate, welded rail should not be installed at a temperature less than 60 deg. (4) Welded track can be surfaced, lined, and otherwise worked without risk, when done at a temperature equal to or less than that at which laid. (5) There are fewer failures in welded rail than in jointed rail, because welded rail eliminates the effect of joint shocks that apparently have some influence on the development of fissures. We have yet to find a fissure defect in welded rail. (Statistics compiled by Sperry Rail Service show a rather large increase in the number of fissures near the rail ends in jointed track and a somewhat smaller peak in the center of rails opposite joints). (6) Proper super-elevation must be maintained on curves for the type of traffic handled to secure the maximum life of rail on curves. (7) It is practicable to transpose welded rail on curves to increase its life. (8) It appears that a less expensive fastening for welded rail is possible. (A sub-committee of the A.R.E.A. is investigating this and, at present, has tests under way). (9) The difficulties we have experienced with continuous welded rail can be eliminated by proper methods of construction and maintenance.

Many engineers have questioned the practicability of continuous welded rail primarily because of the possibility of rail defects. With controlcooling of rail and with joints eliminated, the possibility of rail defects is materially lessened. Present rail steel, without joints, will last indefinitely on tangents. Greater hardness and toughness in rail steel through metallurgical research is, I believe, attainable, which, together with the use of rail lubricators, will increase considerably the life of rail on curves.

Must Cut Costs

If such savings can be realized by the installation of continuous-welded rail, we cannot afford to continue the present jointed construction. We will be fighting competitive forms of transportation for post-war business. Higher speeds with heavier loads must be maintained. Such traffic requires higher standards and greater refinements in track maintenance and, of course, increased maintenance expenditures.

Personally, I am pessimistic about the future of track labor as to quantity and quality. We know that wages will be considerably higher than now and efficiency will be noticeably lower, although the use of work equipment and power tools has conserved many man-hours and will continue to do so. However, we must seek other methods of conservation.

During the war, costs were a secondary consideration; it was a question of getting work done. We must now get back to normal. We must build as permanently as we know how to hold down maintenance costs. Insofar as the track is concerned, welded construction may be the solution.

Comparative Maintenance Labor Costs
Continuously Welded Rail vs. Angle-Barred Rail

	Schenectady Installation		Port Henry Installation	
Test period	8 yrs. 1/1/38 to 12/31/45, incl.		7 yrs. 1/1/39 to 12/31/45, incl.	
Test stretch	NBM—11.2 miles angle-barred 130-Lb. and 131-Lb. RE		Single—13.8 miles angle-barred 130-Lb. and 131-Lb. RE	
Test stretch	SBM—11.2 miles welded 131-Lb. RE		Single—7.9 miles welded 131-Lb. RE	
Average annual tonnage	Angle-barred rail	21 million	Angle-barred rail	14 million
Average annual tonnage	Welded rail	13 million	Welded rail	14 million
Tonnage since laid	Angle-barred rail	189 million	Angle-barred rail	132 million
Tonnage since laid	Welded rail	113 million	Welded rail	109 million

	Man-Hours				Man-Hours			
	Per Mile per Yr		Per Million Tons per Mile per Yr.		Per Mile per Yr.		Per Million Tons per Mile per Yr.	
Maintenance Items	Angle-Barred	Welded	Angle-Barred	Welded	Angle-Barred	Welded	Angle-Barred	Welded
Lining and surfacing	442.9	148.4	21.09	11.42	383.3	263.8	27.38	18.84
Tightening track bolts	41.2	3.5	1.96	0.27	27.1	1.0	1.94	0.07
Tightening and renewing screw spikes	4.1	0.3	0.20	0.02	2.8	4.2	0.20	0.30
Tightening and renewing clips	56.5	56.0	2.69	4.31	14.5	22.8	1.04	1.63
Bucking rail	0.2	0.1	0.01	0.01	0.0	1.2	0.00	0.09
Gaging	37.9	1.2	1.81	0.09	59.0	39.4	4.21	2.82
Renewing angle bars	6.1	0.0	0.29	0.00	1.5	0.9	0.11	0.06
Renewing insulated joints	0.0	0.3	0.00	0.02	4.1	5.6	0.29	0.40
Replacing rail and cutting in closures	183.9	73.5	8.76	5.65	5.9	8.0	0.42	0.57
Transposing rail on curves	6.5	7.9	0.31	0.61	0.0	0.0	0.00	0.00
Spacing joint ties	0.5	0.0	0.02	0.00	0.0	0.0	0.00	0.00
Grinding rail ends	0.0	0.0	0.00	0.00	0.0	0.4	0.00	0.03
	779.8	291.2	37.14	22.40	498.2	347.3	35.59	24.81
Ratio—Angle-barred rail to welded rail	2.68		1.66		1.43		1.43	
Ratio—Welded rail to Angle-barred rail	0.373		0.603		0.698		0.698	

Wood structure, 39 ft. in height, shifted 170 ft. over main lines with no interruption to through traffic. Time—two hours

By R. L. DYKE
Division Engineer, Erie
Hornell, N. Y.

The Tank With Blocking in Place, Ready to Be Moved.

Moving a Water Tank Across 10 Tracks

RECENTLY, the Erie found it necessary to move a 25,000-gal. water tank from the north side of its West-End yard at Hornell, N. Y., across 10 tracks to a new location 170 ft. away. The job was one that required careful planning and quick execution to minimize interference with yard and main-line operations, and, in fact, was completed in two hours, with only minor delays to switching operations and no interference with main-line traffic.

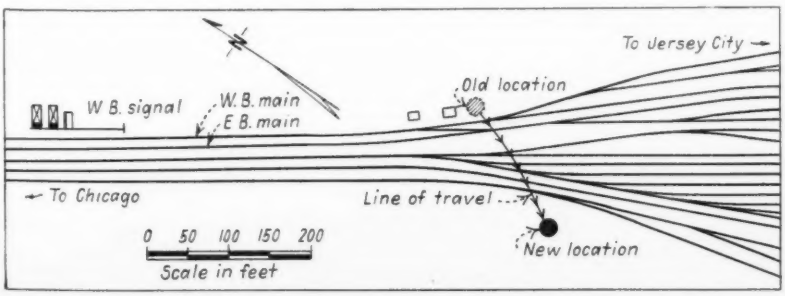
The water tank involved is a wooden tank 16 ft. in diameter by 18 ft. high, and is supported on a multiple-bent timber substructure 21 ft. high. It was constructed about 20 years ago, was in good condition, and was used to supply switch engines and, occasionally, road locomotives. Recently, a new westbound yard was constructed east of the Hornell passenger station and the tank obstructed the view of a westbound main-line signal for trains leaving this yard. Various means were considered for improving the view of the signal, but it was finally decided to move the tank to a new location south of the main line and some old yard tracks at that point, and to effect this move on a series of pipe rollers on timber runways laid directly across the tracks.

In preparation for the move, a new tank foundation and a new pipe supply line to the new location were completed in advance. In fact, everything possible was done to make ready to receive the tank at its new location. To support the tank during the move, a series of 8-in. by 16-in. timber stringers were first bolted to the base of the timber substructure bents, at right angles to the line of move, and the tank was emptied of water. Following this, the tank was raised by jacks and the carrying stringers mentioned were given support on and securely bolted to a series of 12-in. by 12-in. skid timbers, placed parallel with the line of move, which were to act as the upper roller bed in the moving operation. The lower roller bed likewise consisted of 12-in. by 12-in. timbers, which were extended across the tracks as the move progressed. The rollers used were 2-ft. lengths of 4-in. double-strength steel pipe.

The tank was pulled by a cable from a locomotive crane, which was spotted on the most southerly of the tracks to be crossed, and near the new location of the tank. The time to start the move, 9:45 a.m., was selected with the view to causing the least interference with train operations, and the move was completed in two hours, without any delay to main-line trains and only minor delays to yard switching operations. The actual move covered a total distance of 170 ft. across ten tracks, including two main-line tracks and one crossover.

The water tank was out of service five days from the time it was emptied until it was placed on its new foundation, connected up and refilled with water. It was apparently none the worse for the trip, as no leaks developed after the move was made.

This work was planned and carried out by Roy Pierce, master carpenter at Hornell, under the direction of the author.



Plan of West End of Hornell Yard, Showing the Old and New Locations of the Tank

Unusual Pipe Job Done by Novel Method

The Boston & Maine recently completed the repair of three long lines of large-diameter concrete pipe under its Boston passenger yards, without interrupting traffic and without interfering with the movement of tidewater through the pipes. Interesting features of this work, which involved the installation of new steel pipe through the old pipe, included the dangerous diving conditions encountered during inspection and cleaning of the old pipe, and the ingenious methods developed for placing the new pipe inside the old pipe, and for filling the space between them to prevent settlement.

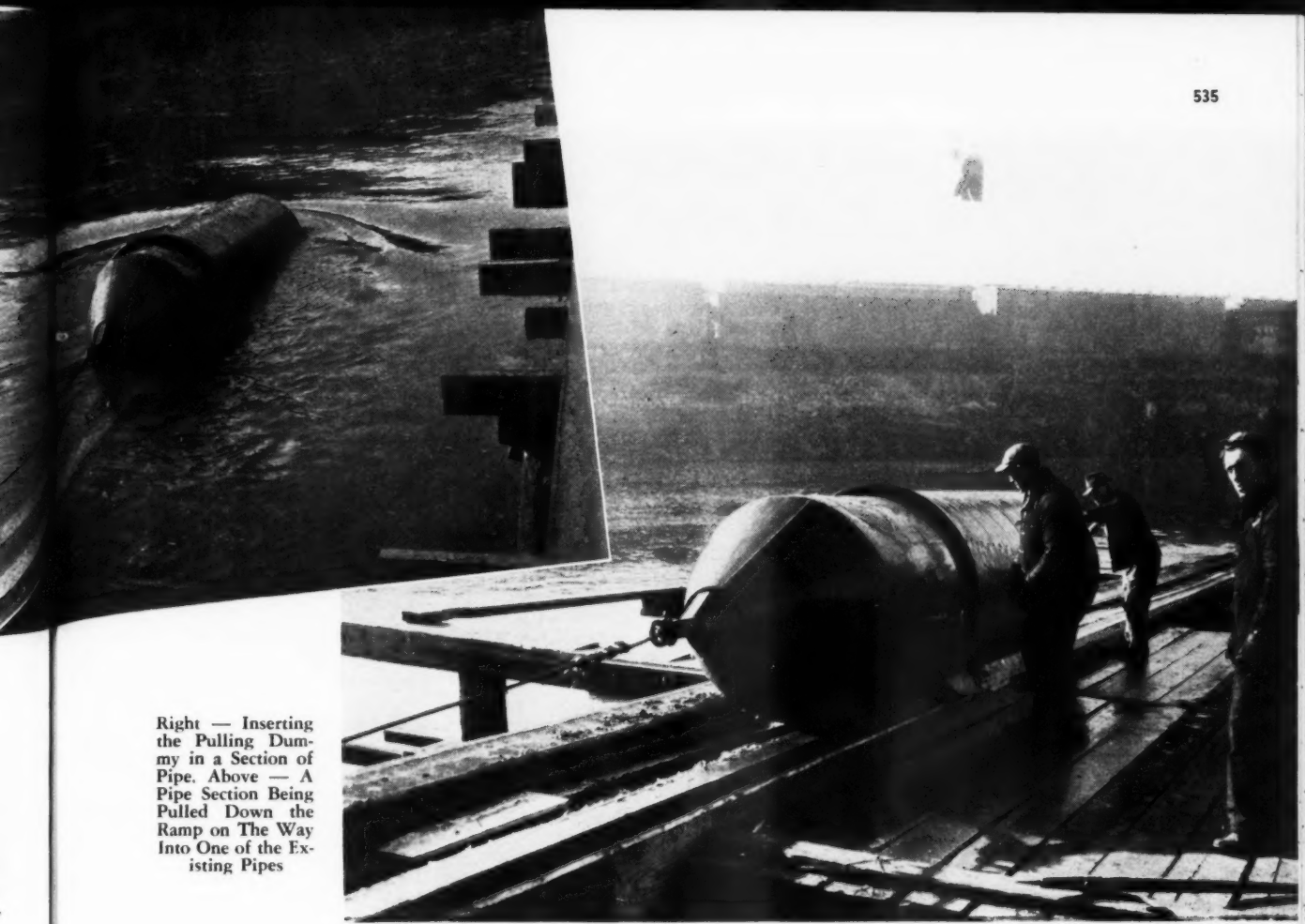
BY H. S. ASHLEY
Engineer of Track
Boston & Maine, Boston, Mass.

THE Boston & Maine recently completed the difficult task of installing new steel tide-water ducts inside three 72-in. concrete pipe culverts beneath its Boston (Mass.) passenger yards, each of the ducts being approximately 1,000 ft. long. This work was done without interrupting traffic on the 36 tracks above and without diverting the movement of the tides through the culverts. Because the old pipes were completely immersed, repair or renewal without interfering with traffic was a problem that presented unusual difficulties. The work took almost two years to accomplish, including months of preliminary investigation, hazardous diving in swirling channel tides, and painstaking study and trials to find a practical and economical solution.

The old 72-in. reinforced concrete pipes were installed in 1929 to provide a waterway for Millers river, a tidal inlet north of Boston, when a series of trestles and drawbridges were removed and filled in to provide a new passenger yard. They were also necessary to take care of certain drainage rights held by the nearby city of Somerville. During construction, the pipes were floated into place and sunk before the fill was placed. They run diagonally underneath eight main tracks and 28 yard tracks of Passenger Yard No. 1 in a general east and west direction, are parallel with each other, and are nine feet apart, center-to-center. The flow line of all three culverts is level.

On June 30, 1943, a cave-in occurred beneath a running track at about the center of the yard, and about 300 ft. from the east end of the pipe crossing, placing several tracks out of service. A wood sheet-pile cofferdam was driven immediately to enclose the caved-in area, and an

Applying Bitumastic Enamel in the Pipe Yard. Note Angles on Pipe in Left Background, Which Were Welded to the Pipes at the Mill for Attaching Skids



Right — Inserting the Pulling Dummy in a Section of Pipe. Above — A Pipe Section Being Pulled Down the Ramp on The Way Into One of the Existing Pipes

examination was made by a diver, which disclosed that the entire top section of all three pipes had failed at this point.

Further inspections were made subsequently to determine the condition of the pipes throughout and to make notes and measurements for the purpose of determining how they should be repaired. These inspections were made by the diver and a number of other members of the terminal division engineer's staff, and were carried out during extremely low tides, which, at Boston, occur once a month and are known as minus tides. Such tides are two feet lower than mean low tide and, when they occur, about one foot of the top of the pipe openings are above water for a period lasting about an hour. During this period, inspections could be made in a wading suit with head above the water, using an underwater diving light, with a generator set on the shore. However, inspection work was hampered somewhat by the fact that all pipes were partially filled with gravel—in some places to a depth of three feet.

These inspections continued until April, 1944, and indicated that other failures were developing, and that the pipes should be replaced. Various schemes and methods for effecting the replacement were then studied and it was finally decided to install smaller steel pipes inside the old pipes and to develop a method for doing this that would not interfere with traffic.

Because renewal by open-cut construction would have interfered seriously with train operation, a plan was finally prepared for pulling the new pipe sections of smaller diameter into the old concrete pipe. From the measurements taken during inspections, it was thought that a 54-in. pipe could be inserted, and permission to do this was applied for and obtained from the Massachusetts Department of Public Works. It was also decided, after some study, to use 10-ft. lengths of steel pipe manufactured by the killed open-hearth process. These were to be fabricated from two ¾-in. steel plates, by making two longitudinal welds, and each pipe section was to have a special bell 6-in. wide, welded on one end, to insure proper joining of the different sections. It was also planned to weld four pairs of lugs on the outside of each pipe section at the mill to be used for bolting oak skids onto the individual sections before they were pulled into place. In addition, the pipe was to be protected with three coats of Bitumastic, one, a shop coat to be applied after the pipe was cleaned of all mill scale, and the other two to be applied in the field before the pipe was placed.

As soon as the general method of repair had been decided upon, a contract was let for the project and preparatory work was begun. First, a trestle, carrying a track, was built on the harbor, or east, end of the job, just north of and parallel with the most northerly pipe. This was to permit the use of a rail-mounted crane to load the gravel removed from the pipes, and later, for unloading the new pipe sections and placing them in position for installation. A similar trestle with a plank floor was constructed parallel with and beyond the west ends of the pipes to support a crawler crane to be used at that point.

Next, two platforms were constructed above the level of high tide, one at each end of the job. The platform at the east end was placed on the bank, on a line with and about 200 feet from the ends of the concrete pipes, while that on the west end was supported on piles, and located about 50 ft. from the ends of the pipes. A hoisting engine was in-

stalled on each of the platforms and the platforms were enclosed to afford protection from the weather.

Cleaning the Old Pipe

A line was then floated through one of the pipes, which was attached successively to larger lines, until finally a steel cable was drawn through and connected with the hoisting engines. A specially-made dragline bucket was constructed which was shaped to fit the bottom section of the old pipe, and telephones were installed at each end of the job for dispatching the bucket and to give instructions to the hoisting engineers.

One at a time, all three lines of pipe were cleaned by pulling the bucket back and forth. After this was completed, a large steel chain was drawn back and forth many times through each pipe line to loosen any gravel that remained. This material was subsequently washed away by the tides, which, at peak stage, subject the pipes to a head of approximately 12 ft.

While cleaning was in progress, mudsill bents and stringers were placed to support the tracks over the pipes at all points where inspection had shown that failure of the pipes existed or was liable to occur. This was done to protect train operations in the yard as well as to insure the safety of the divers.

Divers then undertook to clear the pipes of all loose concrete and bent or broken reinforcing rods. This involved an unusual diving procedure, coupled with considerable hazard, but by working from both ends of the pipes, and also from the top in Yard No. 1, where the initial failures had occurred, it was finally completed without special incident. In this work, the divers had to traverse distances up to 400 ft. in the confined space afforded by the pipes, and the possibility of fouling their air lines was great at all times. They worked in pairs, one cutting reinforcing rods with a hack saw and removing other obstructions, while the other assisted with the lines and gear to prevent fouling or other source of accident. While the old pipes were thus being cleared, an inclined pipe ramp, or skidway, was constructed at the east end of the job leading from the ends of the pipes up to the platform and hoisting engine at this end. This ramp, on a grade of 9.54 per cent, was used to skid the new pipe sections into place in the concrete pipe.

The ramp was supported on pile bents spaced 15 ft. apart, each bent having a 12-in. by 12-in. cap. Two parallel lines of 12-in. by 12-in. stringers, spaced 36 in. apart, formed the ramp proper, and were used as skidways for the oak skids bolted to each of the steel pipe sections. The stringers were bolted to the caps and their inside top edges were protected against abrasion by means of angle-irons. Only one set of stringers was used throughout the job, this set being shifted laterally on the caps as required to guide the new pipe.

As soon as the pipe ramp had been completed, a test pipe section installation was made with a dummy section of pipe, built to correspond in size with the 54-in. pipe, plus bell and skid allowances. This dummy was pulled part way through each of the pipes, but became stuck at certain points in all three, indicating that a 54-in. pipe could not be installed by the methods proposed. Therefore, a new dummy was constructed to conform to the dimensions of a 48-in. pipe, plus bell and skid allowances, and was drawn successfully through all three pipes. Specifications were then changed and 48-in. pipe was ordered, after obtaining the State's approval for the change.

To place the new size pipe lengths, a large torpedo-shaped pulling device, with bullet-shaped noses at each end, was designed and constructed of steel plates welded to a frame of heavy steel rods. The outside diameter of this device was made one inch less than the inside diameter of the 48-in. pipe to allow easy insertion and withdrawal, but, near its rear end four steel lugs were welded equidistant around its circumference to engage the pipe.

Installation of New Pipe

The new pipe sections were unloaded in a storage yard adjacent to the trestle on the east end of the job, and here were given two field coats of Bitumastic. The first of these coats consisted of Bitumastic 70B primer, and the second of 70B enamel, of which the latter was applied hot. After being coated, the oak skids were bolted to them through the lugs previously welded to each length of pipe. Each of the skids was 4 in. by 6 in. in sections, about 10 ft. long, was shaped on each end like a sled runner and was shod with steel.

Each section of pipe was picked up by a crane and placed at the top of the ramp, with the bell end trailing. The pulling device was then inserted and cables were attached to both of its ends. The pipe length was then pulled to its final location in the old concrete pipe by the hoisting engine located at opposite end of the job. The skids were allowed to remain in each section of pipe as placed, but each time the pulling device was pulled back to the platform at the head of the ramp. In this operation, both the ramp and "torpedo" were kept well greased. Following this general procedure, as many as twenty-four 10-ft. lengths, or approximately 240 lin. ft., were installed in an eight-hour day.

The pulling cable was marked with 10-ft. graduations so that the location of any pipe section was known at all times. Also, the last 10 ft. of every pull was made with full throttle to insure proper make up of the joint. After placing a few pipe sections, the winch operator could determine by "feel" when the spigot end touched the bell of the previous section, and also when each pipe section was fully in place. However, a careful system of measurements was used to determine whether the pipe sections were being properly jointed.

With the completion of the installation of the steel pipe sections the space between the old and new pipe was filled with fine sand to transmit the load from the old pipe to the new and to prevent future settlement if the concrete pipe should fail. This was done by sealing the space between the pipes at both ends with sand bags and concrete up to a height of 10 in. from the top of the old pipe, thus forcing the tide water to rush through the remaining opening at a rapid speed. Holes, three-foot square, were then cut in the tops of the concrete pipes about 4 ft. from their ends, and a hopper was placed above each hole for dumping in sand.

Injection of the sand was aided by a jet from a fire pump, which was operated at 250-lb. pressure on a two-inch line. The sand was injected alternately from opposite ends, working with the current of the tides, until the spaces around all pipes were filled to within 10 inches of the top. The hoppers were then withdrawn, the hopper holes and the remaining openings at the ends of the old pipe were sealed, and then the remaining space between the pipes was filled by jetting the sand in from the top opening in Yard 1. When no more sand could be forced in, the amount that had been used was checked and was found to agree closely with the amount that estimates had indicated would be required.

All of the work described was done under contract by T. Stuart & Son Co., Watertown, Mass., under the general direction of T. G. Sughrue, chief engineer, H. F. Fifield, engineer maintenance of way, and under the immediate supervision of the author who, at the time, was division engineer of the Terminal division.

Getting a

Part I

No. 7 of a Series

This installment of the series on the selection, care and operation of track motor cars is the first section of a three-part article on ignition systems. Part I discusses the various types of ignition systems, the fuel-ignition characteristics of different types of engines, the functions of coils and condensers, methods of adjusting and regulating ignition systems, timing the spark, and dry-cell battery ignition using both vibratory and plain types of coils.

By G. R. WESTCOTT
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AMONG the essential parts of an internal combustion engine is the equipment to fire the fuel charge in the cylinder, as it is only through the burning of the fuel that the power is released. This has been accomplished in various ways with different types of engines and has included a flame, hot tubes, balls and plates, high compression and electricity. The two methods now in common use are the high compression system employed in Diesel engines, and the electrical system generally used on gasoline engines. The ignition system employed with track motor car engines is the latter type.

Electrical System

In the electrical system, a spark is made to occur within the combustion chamber, igniting the fuel at the proper time. The equipment required includes: (a) a source of electric current, (b) devices for raising the potential of the current to that required for producing a spark, (c) timing and distributing mechanisms, (d) the necessary wiring, and (e) a spark plug, or in the case of a low-tension system (not used on motor cars), an igniter.

The accompanying table shows various combinations of this equipment ordinarily used on motor cars. In a general way, the table will also apply to most modern gasoline engines using the high-tension type of ignition, although on certain engines a low-tension system is used.

Where the electric current is secured from a battery, the potential is ordinarily 6 volts. This is entirely inadequate to produce a spark of sufficient intensity for ignition. One treatment of the current to produce a means of igniting the fuel is to carry the current through a series of windings around a core of soft iron sheets or wires. Then by making and breaking the circuit at a point within the combustion chamber by the use of a device called an igniter, a self-induced current of 200 to 300 volts results, producing an arcing* across the igniter points as the circuit is broken. This is known as the "make and break" or "low-tension" system, and is fairly satisfactory on slow, constant-speed engines. In this system there is but one circuit and it is therefore simple electrically, but the mechanism required is somewhat complicated. It is said to be less affected by dampness and for that reason is sometimes preferred on marine engines; but it is not adapted for the ignition of engines such as are used on motor cars and was discarded long ago in favor of the "high-tension" or "jump spark" system.

By this latter system, the potential is raised by a combination of the effects of making and breaking the circuit and of the use of an induction coil having two windings—(a) the primary circuit, often called the battery circuit, and (b) the secondary, or high-tension circuit, sometimes referred to as the spark plug circuit. The only connection between these two circuits is through the electro-magnetic field of the coil, except that, for convenience, it is common practice to connect the two within the coil in such a manner that a portion of the primary circuit will serve also as a ground for the secondary circuit.

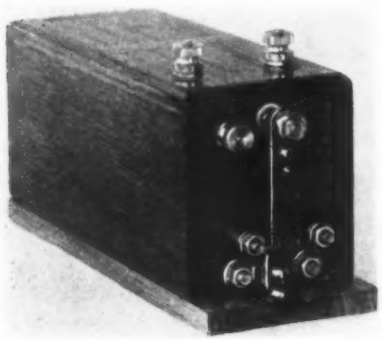
The induction coil consists of a laminated core of soft iron around which are wound a few turns of coarse wire carrying the primary current, and many turns of fine wire in the secondary circuit, all windings being well insulated. A flow of current in the primary winding magnetizes the core and builds up a magnetic field about it. Any change in the magnetic field induces a current in the secondary winding. Such an induced current flows only while the change in the magnetic field is taking place and its potential is dependent on (a) the ratio of the number of turns of wire in the primary winding to the number in the secondary and (b) the rapidity with which the change in the magnetic field occurs. When the primary circuit is closed and the current begins to flow, the

*Distinction may be made between an arc and a spark. When a flowing current is interrupted, its momentum may cause it to jump across the gap at the point of interruption, momentarily causing an "arc." A "spark," however, results when the voltage in a circuit builds up sufficiently to jump a gap, thus starting a flow of current.

core of the coil becomes magnetized slowly and the induced current in the secondary circuit is of relatively low potential. However, by interrupting the flow of the primary current suddenly, the magnetic field is made to collapse very quickly, inducing a secondary current having a potential 1,000 to 3,000 times that in the primary circuit.

Coils

Induction coils used in ignition are of two general types, distinguished by the manner in which the flow of



A Vibrating Spark Coil

the primary current is interrupted. In the vibratory type, often called a spark coil, the current is interrupted by a device called a vibrator. This is a part of the coil unit and consists of a pair of contact points. One of these may be considered as a fixed point, although it is mounted on a spring, permitting sufficient movement so that the pounding of the movable point will damage neither. The other, which is truly the movable point, is mounted on a steel spring called the vibrator spring. When the points are in contact and the current is flowing, the soft iron core of the coil, acting as a magnet on the vibrator spring, draws it downward and separates the points. This breaks the circuit, the core loses its magnetism and the spring again closes the points. The rapid repetition of this action makes a buzzing sound and the device is often called a "buzzer." The vibrator spring projects back somewhat from its mounting on the coil box and this projection is referred to as the "bridge." This type of coil was formerly used on both two-cycle and four-cycle engines, but its use is now generally limited to the former.

As distinguished from the vibrator type of coil, the plain coil has no device for breaking or interrupting the primary current, and for this reason is often called a "dead-head" coil. This is the type of coil used on automobile engines, and on battery-ignited multiple-cylinder four-cycle engines on motor cars. With the plain coil, the breaking of the primary circuit must be done mechanically.

Condenser

With every coil, a condenser is required. In the spark coil, the condenser is contained within the coil box and with the plain coil it is often located inside the distributor housing. In every case, it is connected into the primary circuit in parallel with the vibrator or breaker points.

The condenser consists of a number of sheets of metallic foil separated by sheets of insulating material. The sheets of foil are in two groups, those of one group alternating with those of the other. In shape, the condenser may be either flat or cylindrical, the latter being most commonly used. In this type, the layers of foil and insulation are coiled within a metal outer casing which serves both as a housing and as the terminal to which one group of foil sheets is connected. The other group terminates in a short wire called the lead.

From this construction, it is apparent that the device does not permit the passage of current through it. Rather, it may be considered a reservoir into which the electricity may enter and be stored momentarily, but from which it must escape by the same route by which it entered, that is, through the lead; and therein is the reason for its purpose.

At the moment the circuit is broken by the opening of the points, the current tends to continue to flow and surges against the gap, across which it may jump until the momentum of the flowing current has been relieved. Jumping the gap in this way will cause arcing and result in burning the points. Also, since the potential of the secondary current depends on the abruptness with which the magnetic field in the coil collapses, and since even the small amount of current flowing as the arc is maintained across the gap will delay that collapse, the potential of the induced current will be lowered. The condenser, by serving as a reservoir or cushion by which the surge of the current is absorbed when the circuit is broken, assists both in preventing damage to the points and by halting the current flow more abruptly, in increasing the potential in the secondary circuit. The electric charge that the condenser receives is promptly discharged back through the lead, thus setting up a back pressure that further assists in halting the current flow.

If a condenser is short circuited owing to the insulation within it being punctured, it will not function. Likewise, as in any electrical device, if there is an open circuit due to a broken wire in the lead, a poor connection within the condenser, or a poor ground, it will fail to function. Considerable latitude in the capacity of the condenser is permissible. However, rapid pitting of contact points is an indication of improper condenser capacity. If the pitting is on the positive side, the capacity is too large; if on the negative side, it is too low.

Ignition Characteristics of Motor Car Engines

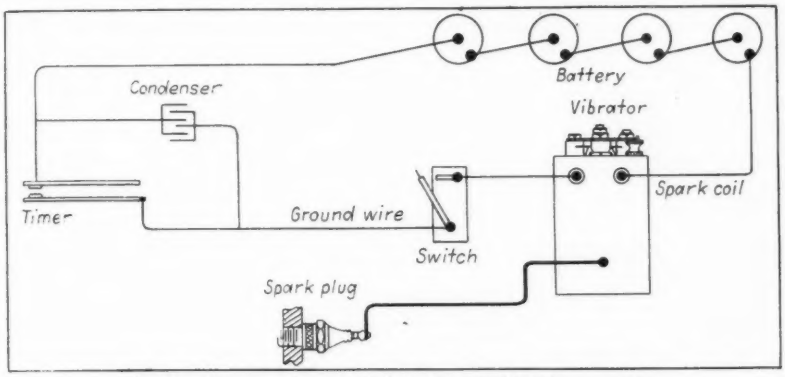
Type of Engine	Number of Cylinders	Source of Current	Type of Coil	Type of Breaker	Timing Mechanism	Control of Spark Advance
2 cycle	1	Dry cell battery	Vibrator or Plain	Magnetic or Timer	Timer	Manual
		(a) Wet cell battery	Vibrator or Plain	Magnetic or Timer	Timer	Manual
4 cycle	1	(b) Magneto	.....	.....	.....	Fixed
	2	(c) Magneto	.....	.....	.....	Manual
		(d) Dry Cell Battery	Plain	Mechanical	Distributor	Automatic
	4 or more	(c) Magneto	.....	.....	.....	Fixed with or without impulse coupling
		(a) Wet Cell Battery	Plain	Mechanical	Distributor	Automatic

Notes: (a) Generally used only when battery is provided for lighting. (b) Usually flywheel type. (c) Rotary type.. (d) Little used.

Adjusting and Regulating

The various parts of any machine or engine must be maintained in correct position with relation to every other part and to the operating conditions. Such a relationship is essential to the proper functioning of the ignition system. In the discussions that follow, distinction will be made between adjusting and regulating. Any change that is made to prepare an engine for service or with

a view to improving its performance and which thereafter will not be changed until required by wear or other conditions, will be considered an "adjustment." Carburetor settings and the settings of spark plug, timer and coil point gaps are of this character. Making changes such as are required to meet demands for variations in speed or power are here termed "regulating." These are made as the engine operates and may be controlled manually or automatically. For example, a timer may be "adjusted" for the length of contact, and thereafter "regulated" to meet speed or power requirements; or a distributor may be "adjusted" for the octane value of the fuel used and thereafter "regulated" automatically for proper spark advance as the speed or load changes.



Wiring Diagram for Dry-Cell Ignition With Vibrator Coil

Timing the Spark

With any electrically-ignited engine, it is necessary that the spark be controlled in its relation to the movement of the piston. This control is called the timing of the spark, and there is no other feature in the operation of the engine that exerts so great an influence on economical performance.

In order to secure a maximum of power from the expansion of the burning fuel, this expansion must take place as the piston moves downward on its power stroke. However, after the spark has occurred, some time is required before the flame spreads to all parts of the fuel charge and the expansive force becomes fully effective. When the engine is running, therefore, the spark must be made to occur sufficiently ahead of the time when the piston reaches top dead center* preceding its power stroke to permit all the fuel to be ignited and expansion to be taking place as the piston starts downward. This is called advancing the spark, and for economical performance, the amount of the advance must increase as the speed of the engine increases.

When the engine is first turned over in starting, however, the first spark should not occur before the piston reaches top dead center; otherwise the expansion may become effective too soon and the engine will "kick back." For starting, then, the spark should be retarded, that is, set to take place at the time the piston reaches top dead center or slightly after. Correct timing requires both adjusting and regulating of the spark.

*Whether a cylinder is in a vertical or a horizontal position, the expression "top dead center" indicates the position of the piston when it has completed its backward stroke and is about to start on the power stroke.

Combustion vs. Detonation

There is also an involved relation between the timing, the compression ratio of the engine, and the character of the fuel used, which calls for adjustment of the spark. After ignition, the burning of the fuel may be by combustion, which is a steady burning; or it may be by detonation, in which, at a point in the burning process, the heat and pressure generated cause the remaining fuel to detonate or explode with considerable violence. Such an explosion causes the well known ping or spark knock that is often heard when the spark is advanced too much.

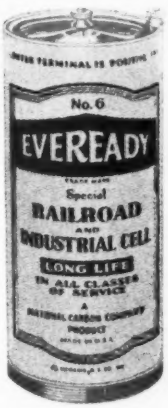
Detonation temperatures are much higher than combustion temperatures and may be destructive to such engine parts as valves and spark plugs. Also, the force of detonation may fracture piston heads or cylinder walls in extreme cases. Since pressure is one of the causes of detonation, it follows that with a given fuel, the higher the compression ratio, that is, the more the fuel is compressed before igniting, the greater will be the tendency toward detonation. But the character of the fuel is also involved, as some fuels resist the tendency to detonate much better than others.

The ability of a fuel to burn without detonation is called its octane rating.[1] While a motor car engine does not usually have a high compression ratio, the fuel commonly used is of comparatively low octane rating, and hence, to avoid detonation, the spark must be advanced less than would be possible with a fuel of higher octane value. The devices for controlling the timing of the spark will be discussed later in connection with the types of ignition with which they are used.

With regard to the source of the electric current used, high-tension ignition systems may be divided into three groups, (a) dry cell battery ignition, (b) wet-cell or storage battery ignition, and (c) magneto ignition. The equipment required in each of these groups differs in many particulars.

Dry Cell Battery Ignition

As indicated in the tabulation of high-tension ignition systems, dry cell batteries are used most commonly as a source of current with single-cylinder, two-cycle engines. The unit of a dry cell battery is what is known as a No. 6 dry cell. This cell is cylindrical in shape, 2½ in. in diameter, and 6 in. long. It has a potential of 1½ volts when fully charged. In a strict sense, it is not a dry cell, but the solution it contains is held in an absorbent material so that, even if the pitch with which it is sealed is punctured or broken, the solution will not spill, regardless of the position the cell may be in.

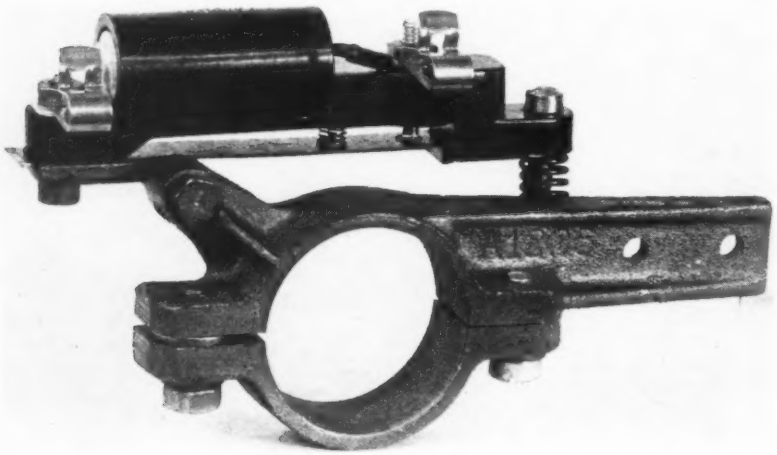


As the cell is used, the voltage drop is not great; but the rate of current flow or amperage, which in a

(1) The basis of the octane (or anti-knock) rating of fuels may be of interest. Briefly, it is a comparison of the anti-knock characteristics of the fuel with those of a mixture of two hydrocarbons, heptane and octane. Heptane is very explosive and will detonate when compressed to one half its volume. Octane, on the other hand, will burn by combustion under considerable pressure. The octane rating of a fuel is the percentage of octane in a mixture of heptane and octane, which, burned in an engine, will have anti-knock qualities similar to those of that fuel: for example, 70 octane gasoline will have the same resistance to detonation as a mixture of 70 per cent octane and 30 per cent heptane. It should be understood that neither octane nor heptane, as such, is contained in gasoline. The addition of Ethyl fluid to gasoline raises its octane rating.

new cell will test about 30 amp., decreases in use until, when reduced to 6 or 8 amp., the cell is generally considered exhausted from the standpoint of its usefulness for ignition purposes.

The cell has two binding posts for attaching the wires. The positive (center) binding post or terminal connects to the carbon core of the cell and the negative (side) terminal to the zinc outer shell. When the cells are connected in series, that is, the center post of one cell to the side post of the next, the voltage of the group is that of a single cell multiplied by the number of cells. So connected, however, the amperage of the group is no greater than that of a single cell.



Modern Timer with Condenser

This is important to remember as it explains why the use of more than four cells is neither necessary nor desirable. The coils and other parts used in this type of ignition are designed for a 6-volt primary current, and four No. 6 dry cells provide that voltage. Adding more cells, up to eight or ten, as has sometimes been done, increases the voltage beyond that for which the system was designed and may do serious damage to other parts of the system. Adding more cells in this way does not, however, increase the flow of current, and is of no advantage in getting a spark. It would, of course, be possible to connect any multiple of four-cells in series-parallel and thus hold the voltage to 6-volts, and at the same time increase the amperage, but this is generally too inconvenient to be of practical value.

The amperage from a battery or group of cells will not be greater than that of the weakest cell in the group. This fact has given rise to the thought that new cells should not be placed in the same battery with those that are partially exhausted as the latter will "rob the new cells of their strength." This is a mistaken idea for, while the battery will function no better than it would if all cells were as depleted as the weakest one, there need be no fear that the life of the new cells will be shortened. If each cell in the battery is tested with a suitable ammeter, only those that are approaching exhaustion need be replaced. However, if cells are equally strong when installed, the life of each will be about the same; and for this reason, the renewal of all cells at one time is quite common.

Testing Dry Cells

Cells should be tested with a pocket ammeter before they are discarded in order to determine whether they are exhausted. When testing dry cells with an ammeter or battery tester, touch the terminals firmly, but remove the contact as quickly as the reading is obtained, for the battery is being short circuited when the ammeter is in contact and the cells are discharging at their maximum rate. Prolonged contact will run down a battery very quickly.

Dry cells should be so placed in the battery box that no terminal will come in contact with any part of another cell or with the side of the box. They should be wedged firmly in the box with split wooden blocks provided by some manufacturers or with dry paper or waste, to prevent any movement through the vibration of the car. Any movement of the cells in the box is detrimental as it may wear or cut the paper covering of the cells or permit the terminals to touch each other, causing short circuits. The practice of carrying pliers, screw drivers, and other tools in the battery box has caused many ignition failures.

Dry cells deteriorate in storage. For this reason, the supply kept on hand should be small, and the oldest cells should be used first. They should be stored in a cool, dry place; excessive heat will exhaust them quickly in storage. Freezing should also be avoided, but in this case, the damage is less permanent. Often a battery that tests very low when frozen will give satisfactory service when thawed. Cells should always be stored in a vertical position with their binding posts up. No metal or other conducting material should be permitted to come in contact with the binding posts.

With dry-cell ignition, the coil most commonly used is the vibratory or spark-coil type. For best operation and battery economy, accurate adjustment both of the tension in the vibrator spring and of the width of gap between vibrator points is required. All coils are designed for convenient adjustment of the gap, but many have no provision for regulating the spring tension except by bending the metal clip on which it is mounted.

For many years the practice in adjusting the vibrator was rather haphazard, the aim being only to secure a strong buzz, little thought being given to the amount of current required. This method may now be considered obsolete for the procedure given below has proved much more satisfactory.

Adjusting the Vibrator

Before making the adjustment, it is essential that the two points match in position as perfectly as possible and fit flatly together. The adjustment should then be made in two steps: First, without concern as to the tension in the vibrator spring, adjust the gap between the points to 1/32 in. and tighten the lock nut so that the position of the fixed point will not change; second, using an ammeter reading fractionally to three amperes, adjust the tension in the vibrator spring so that the current flow registers 0.8 to 1.0 amp. If there is no other provision for adjusting the spring tension, it can be reduced, if the ammeter reading is too high, by prying up under the bridge, thus bending the mounting clip slightly. In like manner, if the ammeter reading, is too low, the spring tension can be increased by tapping lightly on the top of the bridge. Many maintainers adjust the

spring tension so that the ammeter reading is a full ampere. This is done with the thought that there will be a slight decrease in the current flow when the engine is running. Experience should be the guide in this, keeping always in mind that the current flow should be nearly but not more than one ampere.

While adjusting the spring tension, the timer points must be in contact and the switch closed; or, as is most commonly done, the ammeter may be cut in across the points of the switch.

The maintainer who has been accustomed to adjusting the points "by ear" will discover, after the adjustments described above have been made, that the desired healthy buzz will be heard; and he may be assured, also, that the draw on the battery, instead of running as high as 3 amp., as was often the case when the old method of adjustment was used, does not now exceed 1 amp. In addition, the lower current flow will help to prevent pitting of both the coil points and the timer points; points that are pitted require a stronger current flow to produce a satisfactory spark. This method of adjustment may increase the life of the battery as much as 200 per cent, besides giving better performance at all times.

The secondary wires are sometimes detached from the spark plug to test the coil or wiring. In following this practice, current should never be passed through the spark coil without a suitable gap, which should not exceed ¼ in., as the secondary current will ruin the coil by puncturing the insulation inside unless a suitable circuit is provided for the current, such as the gap formed by the spark plug firing points.

Spark coils should be protected from moisture and grease or oil. The contact points should be kept clean and smooth at all times. They should seat flatly against each other and should be perfectly matched, for where the full surfaces of the points are not in contact their life will be reduced. They should be cleaned when necessary with a fine file or emery cloth, taking care that the surfaces of the points are not injured. If it is found that one point is pitted and a corresponding high spot or mound has formed on the other, filing off the mound will only reduce the effective area of the point, and make a bad matter worse.

The Timer

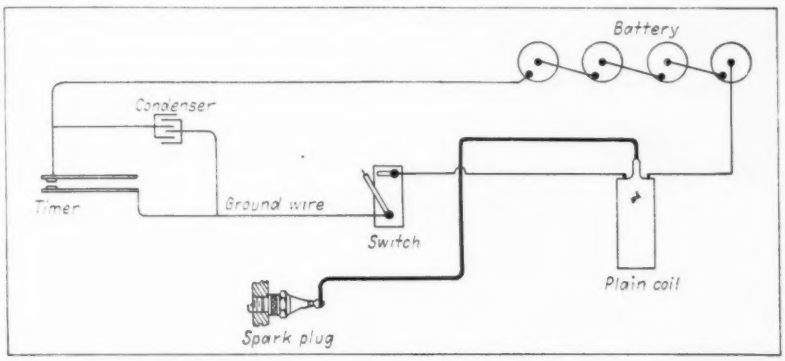
This type of ignition requires the use of a timer. This is a device that makes an electrical contact in the primary circuit at the moment the spark is to be produced. It has two functions: (a) to control, through the length of time its contact is made, the length of time in which sparks are being produced, and (b) to control the timing of the spark in relation to the position and direction of movement of the piston. The length of contact of the timer points may require adjustment. If the length of contact is too short, the spark will be unsatisfactory and the engine performance poor. If, on the other hand, the length of contact is too long, the battery is being wasted, since the current flows when the points are in contact and not otherwise. The manufacturers' instructions should be followed in making this adjustment.

In a multiple-cylinder engine, the length of contact must be the same for each cylinder or unbalanced operation will result. The difficulty of maintaining this condition is one of the reasons why multiple-cylinder, two-cycle engines have often proved unsatisfactory.

The regulation of the spark in relation to the piston movement is made by a manually-controlled timing lever. Recalling that the two-cycle engine will operate in either direction, the timing lever should be in a neutral position when in full retard. From this position it can be advanced in either direction depending on the direction of rotation, and in amount depending on the speed.

Formerly, timers for two-cycle engines were of the ball-and-button or plain blade and button type, in which a button mounted on the hub of the flywheel made the electric contact directly with a ball or blade mounted on the timer. In this case, the circuit was completed by grounding to the engine itself through the button on the flywheel. On some two-cylinder cars, ball and roller timers were used which were operated by the crank shaft instead of the flywheel. Timers now generally used are of the contact-point type, in which points similar to the breaker points on a spark coil are brought into contact to close the circuit. The closing of the points is actuated by a button or rubbing block on the flywheel hub brushing against a spring on which one of the points is mounted. Here the circuit is completed through a separate wire rather than by grounding through the engine.

This type of timer has a condenser cut across the contact points to assist in speeding up the action of the timer. Like the condenser in the spark coil, it cushions the shock of breaking the current flow and thus prevents the burning of the points due to arcing across them. It is also said to give smoother operation when the strength of the battery is low. For example, without a condenser at the timer, an engine is likely to miss firing when the battery registers less than 6 to 8 amp, while if a condenser is used, smooth performance may continue until the battery is completely exhausted.



Wiring Diagram for Dry-Cell Ignition with Plain Coil

Dry Cell Ignition With Plain Coil

The use of the modern contact-point type of timer suggests a rather radical change in the equipment for dry-cell ignition on two-cycle engines. Reasoning that this timer, equipped as it is with a condenser, causes the same sudden break in the primary circuit that is caused by the opening of the breaker points in the distributor on a four-cycle engine, it appeared that this break might be utilized with a plain or dead-head coil to produce the spark, and the vibrator coil eliminated. Tests being made on several railroads have demonstrated that this is true.

With this equipment there is a single spark occurring at the moment the circuit is broken instead of a shower

(Continued on page 548)

What's the ANSWER?

When Laying Rail

When laying rail, what details should be given attention to insure that the correct expansion allowance will be provided and maintained? What is the relative importance of each?

Must Know Temperature

By S. H. Shepley
Supervisor of Track, Elgin, Joliet & Eastern, Joliet, Ill.

To insure correct and equable expansion allowance one must possess an accurate rail thermometer and take the rail temperature on the shady side of the rail several times during the day, whether there seems to be any change in atmospheric temperature, since when the sun is shining, rail temperatures may vary as much as 20 to 40 deg. from that of the air.

With a rail temperature of 100 deg., F., or more, no allowance for expansion is necessary. For a temperature of zero the expansion allowance for a 39-ft. rail should be $\frac{5}{16}$ in. and between these points the expansion should vary by about $\frac{1}{16}$ in. for each increment of about 20 deg. Generally, it is desirable to use shims $\frac{1}{8}$ in. or thicker, since they do not break so easily when removing them from the expansion gap.

To insure maintenance of the correct rail gap after the shim has been installed, it is essential that at least two bolts, one on each side of the joint, be tightened before the shim is removed, and at least four bolts should be tightened before trains are allowed over the rail. Furthermore, the rail already laid should not be bumped by the one that is being laid, as this will make the shims difficult to remove. Neither should bumping be resorted to at closure for trains to pass or at the end of the day's work.

Assuming that the correct expansion allowance has been provided, the only feasible way to maintain it is to install enough anti-creepers to hold the individual rails from longitudinal movement under traffic. While this movement is generally in the direction of traffic, it is not always so, for which reason knowledge of the behavior in expansion of the old rail should be used as a guide for placing the anchors on the new rail.

Cleanliness with respect to both dirt and rust on rail and fastenings should receive careful attention. The fishing surfaces of both rail and joints should be well oiled, packed with joint packing, or painted with a rust preventive to eliminate frozen joints, which are sure otherwise to result eventually and dislocate the uniform expansion no matter how carefully it may have been provided.

I would hesitate to emphasize the relative importance or even to list in order of importance any of the operations or devices that have been mentioned as essential to maintain uniform expansion. They are all important, and if any of them are disregarded, uniform expansion will be defeated and much benefit will be lost.

Must Anchor Rail

By F. R. Layng
Chief Engineer, Bessemer & Lake Erie, Greenville, Pa.

It is of the utmost importance to provide for the correct expansion allowance at each rail end when the rail is being laid. It can never be done satisfactorily later. To this end, the following steps should be taken and care exercised to insure that none of

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in July

1. *How small can a mechanized rail gang be and yet produce effective results? What power equipment should be assigned? How should the gang be organized? Does the weight of the rail make any difference? What other factors require consideration?*

2. *To what extent can the segregation of the larger particles in stone and gravel be prevented when stocking these materials for concrete construction? How can this be done?*

3. *What causes ties to split? Is this tendency more pronounced in some woods than in others? Why? Is it affected by traffic? What measures can be employed to overcome it?*

4. *Is there any advantage in providing camber in pipe culverts when they are installed? Why? If so, how much? Are there disadvantages? Can this be done where they are jacked into place? How?*

5. *Are present standards with respect to width of roadbed and depth of ballast sufficient to maintain track to the standard of excellence that is demanded by the speeds of today and the prospective speeds of tomorrow? What action is desirable?*

6. *In what ways and to what extent has the present recession of the groundwater table over wide areas affected water supply? What must be done to overcome the trouble?*

7. *When a motor car has been repaired, should it be returned to the gang that sent it in? Why? If not, what disposition should be made of it?*

8. *What finish should be given wooden floors in passenger stations? Why? Does the kind of wood or the importance of the station make any difference? Why?*

them is overlooked in doing the work:

First and most important, use the correct size and type of expansion shim for the particular length of rail that is to be laid and for the rail temperature at the time it is laid. Practically all roads have tables showing the amount of expansion to be allowed for each case. A thermometer should be used to determine the temperature of the rail, and this reading should be checked frequently, because it may fluctuate between wide limits during the day.

A supply of metal expansion shims, varying in thickness from $\frac{1}{16}$ to $\frac{1}{4}$ in., by increments of $\frac{1}{16}$ in., should be provided and, as each rail is laid in the track, the correct expansion shim should be placed between it and the abutting rail, either at the top of the head or between the flanges at the base. Preferably, the shim should be placed at the base of the rail, since there is greater area at this point for the shim to rest upon and, as the web of the rail protects it, there is less danger that it will be knocked out and the expansion lost.

In addition, where cranes are used, it is undesirable to place the shim at the top of the rail and then have it run over as the crane advances to the next rail. When rail is laid around sharp curves, the inside corners of the base are frequently touching while the outside corners are much farther apart, in which event the inside corner of the base is the only place where the shim is really effective.

Joint bars should be applied and bolted into place before the shims are removed, but this work should not be carried on closer than ten rail lengths from the front. On the other hand, when angle bars are used it will be necessary to remove the shim from the base of the rail before they are applied. In this case, application of the shim at the head of the rail is more desirable.

Finally, sufficient anti-creepers to hold the rail from longitudinal movement must be applied before trains are allowed to use the track. All bolts should be retightened as soon as possible after the original installation and should be retightened at successive intervals until they have assumed final position.

It is difficult to assess the relative importance of each step, because, if any one is neglected, correct expansion will be lost. In general, it is of first importance that rail be laid with correct expansion allowance and, second, to see that it is maintained. If this is not done at the time of laying, no amount of after maintenance will correct fully the situation created by the original neglect.

Metal Nosings on Bridge Piers

What benefits are derived from metal nosings on bridge piers? Under what conditions should they be provided? What are the relative merits of steel rails and angles for this purpose? How can they be anchored?

Removal of Drift Costly

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

It is often a very costly operation to remove trunks of trees, heavy timbers and other accumulations of debris that are prone to lodge against bridge piers. Many streams rise quickly and flow at high velocity after a heavy rain and, if they carry much drift, it may lodge against the piers, wedging so tightly that it becomes necessary to employ work trains, derricks and other equipment, as well as various manual methods, to clear the accumulation away before serious trouble and damage occur.

Usually floating drift in a high-velocity current lodges against piers much faster than it can be removed. It is also true that the rate of this accumulation can often be traced to the design and construction of the upstream face of the pier. I do not recommend that steel rails or angles be placed as metal nosings in streams that carry much drift. The reason for this is that when soft woods lodge against the pier, they are forced heavily against the masonry surface by the enormous pressure of further accumulations and the weight of the water against the mass, so that the sharp and unyielding nose tends to cut a deep groove into the wood, which makes it difficult to remove the tree trunk or timber, whatever its form may be.

For such streams a shaft or a heavily reinforced pipe can be installed as the nosing of the pier, so applied that it is free to revolve. If such an arrangement can be employed, it would have a tendency to revolve when the drifting timber struck the pier, thus moving it on.

Prefers Nose Plates

By A. R. Ketterson
Engineer of Bridges, Canadian Pacific, Montreal, Que.

On piers subject to high velocity currents or the pressure of debris, there should be protection in the form of nosing of some type. Steel rails are provided for this purpose on some piers, and steel plates on others. If this protection is installed when the substructure unit is being built I have more confidence in a well-designed nose plate than in several rails, because the plate can be anchored securely to the masonry by means of anchor bolts and is complete, whereas the individual rails are independent of one another and can be loosened by the pressure to which subjected.

In comparing the merits of rails and steel angles, if it is considered that a long-leg angle on the nose is all that is required, it seems that the angle then assumes the value of a plate. On the other hand, if it is considered that several angles should be installed they will perform the duty of a series of rails and will be subject to dislocation. Generally speaking, therefore, if it is necessary to protect the nose of the substructure units, a reasonably wide plate, fastened securely to the masonry, seems appropriate.

In the case of attachment to a concrete pier about to be built, the plate may form a part of the forms and be provided with anchor bolts which project therefrom and are encased in the concrete. However, if the attachment is to be to an existing pier, it will be necessary to drill the anchor-bolt holes in exact position, drive the bolts and grout them before the plate is placed and fastened. Bolts with round heads should be used to reduce resistance by the bolt heads, which could be sheared off by the pressure of the floating debris.

Make Integral with Pier

By G. S. Crites
Division Engineer, Baltimore & Ohio, Baltimore, Md.

Bridge piers in channels of fast-running streams that carry ice, logs or quantities of drift should have upstream protection that will take the impact or thrust of the floating mass in a way that will not injure the pier. For piers consisting of pile clusters the piles should be encased so as to prevent logs or drift from lodging between piles, and the encasement should be filled with heavy material to provide inertia against shock. A nose of steel rails or suitable steel shapes should be fastened upstream to take the thrusts or shocks of fast-moving drift or thrusts from banked ice.

The best arrangement for such protection is to drive one, three, six or more piles as required and then band the tops with strap iron or cable and secure them to the pier. A heavy rail or angle should be spiked or bolted securely to the front pile. This fender will relieve the pier to a large extent from both shock and thrust.

Similar protection is needed for piers constructed with steel piles, where such piers are or may be subjected to the impact of ice or drift. In such cases the protecting piles should be encased in non-corrosive metal and weighted against shock. Suitable nosing should be provided in front of such piers. Whether piles, angles or wood piles will be used will depend in large measure upon the stream load expected. If wood piles are used they should be nosed and secured in the same way as for a wooden-pile pier.

Many old stone masonry piers were not protected on the upstream end, with the result that repeated impacts from drift and ice or thrusts upon individual stones have loosened them. The remedy is to point up the pier and provide protection. In many instances this can be done by putting a nose on the pier with reinforced concrete and embedding in this a heavy rail or suitable steel shape. If money is not available or a concrete nose is not economical for an old pier, it may be best to protect it with wood fenders, as suggested for pile piers. Modern concrete piers should be designed with the nose as an integral part of the pier.

Keeping Suctions Free of Ice

How can the intakes of suction lines be kept free of ice during low temperatures?

Every Case Is Special

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Suction lines frequently give considerable trouble from many causes, but particularly where the depth of the water is not sufficient to permit the intake lines to be placed far enough below the surface of the water to escape the action of floating drift, trash or ice. In shallow water it often becomes necessary to construct a rock or concrete well in which to place the suction line to a satisfactory depth, to protect it against floating ice.

One method that has been used successfully is to construct a well, or box protected by an iron-bar grillage on the upper and lower sides, to allow water to flow into and out of it, but, at the same time, to protect the line from floating matter of all kinds. The grillages must be placed far enough below the surface of the water to insure that they will be in the clear of floating material.

In some cases, where the rise and fall in a stream is over an unusual range, it may be necessary to place the intake inside a box which can be raised and lowered as the water level fluctuates. In small streams with rock bottoms, the line can often be protected by building a dam about the water line in such a way that the water will come back into the suction line, while the ice and drift float on by. If the temperature becomes so low that the entire water area is in danger of freezing and coating the top of the box or well with ice, this may be of advantage. However, every individual case presents its special problem which must be solved by methods that are best adapted at that point.

Covers a Wide Field

By E. M. Grime
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

This question covers a wide field and includes a series of varying conditions that become almost as numerous as the existing intakes. In other words, the design of the intake will depend upon the particular conditions encountered, such as whether the water is taken from a reservoir, a small creek, or a deep or shallow river, which may flow swiftly or slowly, and whether the water is clear or turbid. Also, it will depend on whether there is a wide variation in the volume of flow, whether there is considerable disturbance from ice flows, or whether ice formation is a problem of consequence, as it is not likely to be where the intake opening can be kept many feet below the surface of the water.

Except in the case of an intake in a deep reservoir, it is usually desirable to interpose an intake well between the intake pipe and the pump suction line. By providing a slight grade downward toward the intake well, debris getting into the intake line will float on down into the well where it can settle and be removed readily by a jet pump.

An intake well in a small stream may require the construction of a dam to impound sufficient water to raise the level above the point where, if ice does form, sufficient free water will remain below the ice. An intake line should always be located in a manner to cause no obstruction to the regular flow of the stream. If it does make an obstruction, then, if it is not dislodged by the stream, it may cause the formation of a gravel or sand bar which will close the opening eventually.

Since, under normal winter conditions, ice forms or floats at the water surface, the intake must be placed at a point below where ice forms. If this is impracticable, then a depression must be made where water can accumulate below ice level. This may be filled with gravel or rock and thus offer no obstruction above stream bed. The area of the depression must be such that there is no increased velocity sufficient to suck debris into the intake area.

This scheme will work out to advantage in a swiftly-flowing stream, such as the Yellowstone, where anchor or needle ice has been seen to dart down to the river bed and there form a solid mass of ice several feet below the water surface. Under favorable cold-weather conditions such a mass may build up rapidly and form a solid mass of ice, sufficient to dam the river and cause it to rise several feet above normal, creating a large ice jam, backing the water up for several miles.

Regardless whether an intake is subject to interference by floating ice, sifting silt or other debris, the important feature is to provide arrangements that will result in low velocity of inflow, thus avoiding the formation of a vortex at the entrance to the pipe.

Must Classify Ice

By Division Engineer

Before discussing the methods of keeping intakes free of ice, it becomes necessary to classify the different ice formations and their behavior. Ice forming on the surface rarely causes trouble, unless it becomes of sufficient thickness to interfere with the flow of water to the intake or is broken up by winds or in thawing.

Anchor ice forms only when the water is in motion, when the temperature is near or below zero, and the night is clear. It does not form under surface ice or during cloudy weather. It forms near the bottom, and small particles will attach themselves to the

intake screen very rapidly, until the openings are closed. It then becomes loose as the sun rises or the temperature increases. This ice is extremely difficult to remove. Reversing the flow through the intake line is sometimes effective in dislodging it, and steam jets are used in some cases to keep the intake clear. Locating the intake in quiet water is the most effective method of protecting against the effects of anchor ice.

Frazil ice forms only in a swiftly-flowing water. As with anchor ice it forms on clear, cold nights or on windy, cloudy days. It forms as crystals and is pulled into the intake or suction line, sometimes shutting off the water. The methods of control to be followed are the same as for anchor ice.

Probably, the chief trouble experienced with ice in railway water service is from slush ice, which may be a combination of frazil and anchor ice mixed with snow and broken surface ice. While such a mass may clog the intake, it can be handled more easily than other forms, since it is usually present only when the temperature is high enough to prevent its freezing into a solid mass. It may be controlled by keeping it away from the intake by means of sheeting or surface baffles.

Power Machines for Ties

To what extent is there a field for mechanical devices that can be employed for renewing ties? What features should they possess?

Too Many Operations

By Engineer of Ties

The complete operation of renewing a tie involves not only the pulling of the track spikes, the removal of the tie plates, the stripping of the ballast from around the tie, and, finally, the pulling of the old tie from its bed and clear of the track. This is only preliminary for it also involves the preparation of the ballast bed for the new tie, the insertion of the new tie in the track, the replacement of the tie plates, the driving of the track spikes, the tamping of the ballast under the new tie and those adjacent thereto, the dressing of the ballast section and finally, the disposal of the old tie.

Obviously, no one machine can perform all of these various operations, or if one were devised it would not be likely to perform such widely divergent operations economically. Several machines, including tie pullers and tie saws have been used, but up to the present they have not come into universal use. Further study may develop something worth-while, but to date trackmen with the necessary hand tools seems to be the best means for renewing ties.

In Process of Development

By Roadmaster

I consider this to be one of the best questions that have been asked in these columns in recent months, for it is calculated to set us thinking along lines on which development has not been so rapid as it has along some others. That there is a definite reason for this lag becomes evident, however, when the whole situation with respect to tie renewals is considered.

Formerly, rail renewal was considered a special job for the supervisor and the relatively small extra gang that was organized especially to lay the rail, and which was later assigned to surfacing the newly-laid rail. This practice was continued for years, each supervisor laying his own rail, independently of all other districts on the system. Many are the tales that have been told by both foremen and supervisors of the efforts that were made to establish new records for the amount of rail that could be laid in a day or a week, every operation being performed manually. It was not until rail sections became too heavy to be handled by hand, however, that railway men were willing to mechanize their gangs and thus provide the incentive for manufacturers to develop a wide range of equipment suitable for the various operations that must be performed to produce a satisfactory overall job of laying rail.

Ties provide an almost parallel case, except that tie renewals have been considered the special prerogative of the section gang. Like rail, however, their renewal requires the performance of a considerable number of independent operations that are not at all similar and which, if performed mechanically, would require separate machines.

As soon as power machines and tools suitable for the various phases of laying rail became available it became evident that there would be no economy in outfitting the small district or division gangs that had been employed, with mechanized equipment. In the first place, the small gang did not contain enough men to make a balanced operation possible; second, it would require too many units of the several types to outfit all of the gangs on a system; and, third, the machines would be used for so short a time in any year as to make their ownership uneconomical.

The only alternative that presented itself was to increase the size of the gang as a whole, by increasing the sizes of the units that comprised it, so that each unit would be self-contained and could be assigned permanently to a particular task, together with a power machine or machines suitable for this assignment. This took the rail gang out of the district and division class and put it on a system basis, with a program that keeps it busy from the beginning to the end of the working season, and thus places the ownership of the power equipment on an economical and highly profitable basis.

Already, some manufacturers have developed power machines that can be employed in certain of the tasks that combine to make up tie-renewal operations as a whole. In themselves, some of these machines are effective and desirable for the work they are designed to perform, but neither they nor any similar device can be made to fit into the picture so long as tie renewals are retained as the social prerogative of the section gang.

In the first place, no normal section gang inserts enough ties in a day to make it profitable to own machine equipment that can be applied to the work. This is true even if the gang were able to work through the season and complete its tie renewals without interruption. But no normal section gang ever does this, for so many calls are made upon its time which cause interruptions, sometimes lasting several days, that machines of this type assigned to section gangs would be idle a considerable part of the time; an uneconomical arrangement.

As I view the matter, therefore, extensive use of mechanical equipment for tie renewals must wait until maintenance officers generally are willing to take this work out of the hands of their section gangs and put it on a production basis, as they have already done with rail. To equip section gangs or a multiplicity of small extra gangs, as has been tried on some roads, with suitable machines would mean too much equipment to start with, and too much equipment lying idle too much of the time, as a second and determining factor.

Melting Ice on Platforms

Can salt or calcium chloride be used for removing snow and ice from platforms? What are the advantages? The disadvantages? What other methods are satisfactory?

Both Are Used

By T. H. Strate
Division Engineer, Chicago, Milwaukee, St. Paul & Pacific, Chicago

Both of these materials are used for removing ice and snow from platforms. We have tried both, but the salt is used in preference. The advantages of these materials lie in the fact that they will keep platforms from becoming slippery during the freezing period. Among the disadvantages are the tracking of the chemicals into stations, offices and passenger cars, with the result that floors and floor coverings may be damaged. If they are brought in in sufficient quantities they may also damage any steel work with which they come into contact. Furthermore, it is generally accepted that salt is harmful to the surfaces of concrete platforms, and in some instances its use for the purpose under discussion is prohibited.

Obviously, so far as snow is concerned, the best way to care for a platform is to remove the snow with shovels or plows. Where labor is scarce, however, it becomes necessary to do the next best thing, and this may be the use of the chloride of sodium or calcium. Where snow has been removed with plows or shovels, slippery surfaces can be corrected by sprinkling them with sand.

Does Not Use for Snow

By General Inspector of Building

I have never made a practice of using either common salt or calcium chloride for the removal of snow from platforms. Shovels, if the platform is of small area, and plows for those of larger dimensions, are the most effective of all of the schemes I have tried or seen tried. In fact, neither the salt nor the calcium chloride does a good job when it comes to the removal of snow from platforms. This is particularly true where the snow is light and feathery. However, if the snow is drifted and is well compacted these chemicals may do better, but it requires several applications and takes a long time for complete disposal. In the meantime, where they are effective, the snow becomes saturated with the melting water and is slushy to the point where it becomes a mess.

Both the salt and the calcium chloride are effective in the removal of ice, being particularly valuable during and after a sleet storm in which the sleet freezes tenaciously to the surface of the platform. They have the advantage that a supply of either can be stored on the premises served by the platform and can be distributed over the surface by the local force without the necessity for calling for outside help. Another advantage is the relatively low cost of both the chemicals, so that they can be used generously when needed.

There are several disadvantages in their use. In the first place, to be most effective, both should be prepared in relatively coarse grains. If they are too fine they dissolve too quickly and lose their effectiveness. The coarse grains, however, make walking on the platform more difficult and are quite annoying.

Both, after they have been in solution, leave a heavy efflorescence on the surface of the platform, unless flushed off with a hose or washed away by rains. While in solution it gets on shoes and may be tracked into buildings, to the detriment of floors or floor coverings. When it dries it leaves the same white efflorescence on both floors and shoes.

Another and more serious objection is that both the salt and the sodium chloride cause the surfaces of concrete platforms to spall, so that continued or frequent use of them may cause serious deterioration. It is believed that this can be overcome to some extent by the use of air-entrained concrete. It must be kept in mind, however, that only a very few of the latest platforms have been constructed of this material, the great bulk of those in existence having been built before air entraining was developed.

Alternate Freezing and Thawing

What, if any, special precautions should be taken in maintaining track during periods of alternate thawing and freezing? Does the speed of trains or the volume of traffic make any difference?

March Most Critical Month

By C. Halverson
Division Roadmaster, Great Northern, Willmar, Minn.

This is a problem that confronts those roads particularly which operate in northern sections that are subject to severe winters and deep freezing of the ground. In such territory, March is usually the most critical month of the year for the maintenance forces, when special precautions must be taken to maintain track in good-riding condition because of alternate freezing and thawing weather, since the ordinary form of surfacing will make conditions far worse.

When there has been unusually severe weather with low temperatures early in the winter, with only a small snow cover, the ground will be frozen to a considerable depth. This always increases the disturbance of the roadbed, because of the severity of frost action. The condition is always aggravated during periods of freezing and thawing temperatures, and during such periods a close check of the track must be made almost constantly, consistent with prevailing conditions. Roadmasters and supervisors should make frequent trips over their districts to locate any irregularities in the alignment and cross level and then follow up with the forces under their jurisdiction to insure that corrections are made quickly.

All shimmed track should be given special attention during this period. Those who make inspections on motor cars should stop to observe whether the rail has satisfactory bearing on the shims and to make frequent checks of the cross level.

If conditions become such that the forces available are unable to keep the irregularities in the track in check, the speed of trains should be restricted until corrections can be made. Where there is considerable snow on the ground and a lot of slush is dragged into the flangeways of crossings at grade, to form ice, the condition is likely to become hazardous. For this reason, highway grade crossings require extra supervision at this season. Switches must also have adequate drainage to get rid of water from thawing snow and keep them in operation.

Alternate freezing and thawing causes sudden and extensive changes in rail temperature, and any defect that may exist in the rail may be aggravated further by mechanical de-

fects in locomotives and cars during these temperature changes. Obviously, the denser the traffic and the higher the speed of trains, the greater is the need for more refinement in track maintenance.

Dry Track Does Not Heave

By G. S. Crites
Division Engineer, Baltimore & Ohio, Baltimore, Md.

If the ballast and roadbed are dry there should be no disturbance from frost, so that the problem of maintaining track during periods of alternate thawing and freezing resolves itself into that of draining the roadbed and of keeping the ballast clean. Where either, or both, is impossible, certain precautions must be taken when thawing and freezing take place alternately.

Where the area affected is small, as at the end of a bridge, under viaducts and similar places, or around water columns or along track pans, it is generally possible to dig enough salt or calcium chloride under the ballast to lower the freezing point of the wet ground enough below the temperature of the atmosphere to avoid alternate thawing and freezing. If this is not possible, there is nothing to do except to protect against heaving and settling track and, at times, against the track being frozen out of line.

If conditions are bad, slow orders must be resorted to, but if important schedules will be disrupted by slow orders, steps must be taken to keep the track safe for normal speeds. This should be done without disturbing the ties from their beds, except in those extreme cases where it may be necessary in maintaining clearances.

In most places, judicious shimming of low places during the freeze will take care of riding conditions. However, spike lining may become necessary if the track is frozen out of line. Where this occurs it seldom is found that the track will move from its spike-lined position when the frost goes out. If shimming is resorted to, the shims must be adjusted or taken out as the heaved places thaw.

It can be expected that track subjected to fast or dense traffic will have good ballast and good roadbed conditions, and that it will be free from disturbances from frost, except in rare cases. However, such track must be maintained in better line and surface than less important track. This can usually be done by removing the tie plates in some places or by shimming at others. The plates should be restored, however, and the shims removed when the frost is out.

Width of Ballast Shoulder

What shape should the ballast shoulder be? How wide? Do these differ for different kinds of ballast? Does the length of the ties make any difference?

Ballast Determines

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Many considerations are involved in arriving at a decision as to what width of ballast shoulder should be made standard. Obviously, the dimensions and shape of the shoulder required for crushed stone are not the same as that which must be provided for a cementing gravel. In many cases, different varieties, and even different sizes, of crushed stone demand different shapes and widths of shoulder. This is demonstrated easily by comparing trap rock with a relatively soft limestone, or by observing the requirements of coarse and smaller sizes of the trap rock.

Every railway has a standard roadbed section and most of them have several standards which they apply to lines of varying importance or vary in accordance with the character of the roadbed materials. These materials are by no means similar in all cases, for here is an embankment or even a cut which is composed entirely of clay; another is made of broken stone or a mixture of clay and stone. There are also many miles of ordinary soil and many other miles that are composed of gumbo.

Again, water conditions may be as varied as the materials of which the roadbed is composed. Some of these materials, such as broken stone, sand, gravel and other porous materials may drain freely; others, including heavy clay, gumbo and other water-retaining materials, may do the reverse. Soggy roadbed tends to slip and to form water pockets. All of these roadbed conditions affect the ballast in several ways, including the shape and width of the shoulder.

To be more specific, the shoulder of the ballast should be wide enough to hold the track in line, and this width is determined to a considerable extent by the volume of traffic and the speed of trains. Consider stone and slag first, because these materials are found on most of the high-speed heavy-traffic lines throughout the country. Under ordinary conditions, the depth of the ballast, provided the roadbed is dry, should range in depth from 20 to 24 in., a part of which, say 12 in., should be a good quality of sub-ballast. In this case the width of the ballast shoulder should be such that the ballast toe line is 50 to 54 in. from the rail, on tangents. On curves, the outer shoulder should be somewhat greater and the ballast toe line correspondingly farther from the rail.

For gravel, cinders and other light, porous materials, the shoulder should be some wider to maintain the ballast under the ends of the ties and thus reduce the amount of center-bound track. Incidentally, an ample shoulder on any type of ballast increases the intervals at which the track must be surfaced out-of-face. The shoulder on these materials may well be as follows: on tangents, 66 in.; on curves, 72 to 78 in.

Between the rails stone ballast should be dressed slightly below the tops of the ties, while outside this should be increased to 2½ in. Between tracks on multiple-track lines, the space should be filled and leveled off about 2 to 2½ in. below the tops of the ties. Gravel can be kept a little higher, but should be sloped somewhat more sharply outside the rail.

In general, the length of the tie is not a factor in the width of the shoulder, although it will affect the overall width of the ballast section.

No Set Rules

By Roadmaster

So many variables, including those of the ballast itself, enter into the design of the ballast section that no one can say categorically what the shape and width of the shoulder should be. What may be the ideal for one kind of ballast in a certain area or on a certain territory may not be so suited for the same ballast under another set of conditions. In the same way, the best section and width for a given ballast may be completely unsuited for another kind of ballast under identical conditions.

One of the principal functions of the ballast shoulder is to hold the track in line under the traffic that passes over it. Another is to support the ballast under the ends of the ties to retain it in place and thus reduce the tendency of the track to become center bound. Any width of shoulder that will accomplish these purposes should be satisfactory from these points of view. However, because of wide variations in the characteristics of the ballast itself, the shape of the shoulder

may vary between somewhat wide limits, from the completely boxed-in design to a section that resembles the old dirt section that prevailed where no ballast was used. Just where between these two extremes one should stop will depend on the material used as ballast.

Ice in Downspouts

What is the best way to clean out downspouts that have become filled with ice? What other methods are effective?

Steam Most Effective

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Downspouts often become blocked at various points by reason of trash and leaves lodging on the roof and in the valleys and later washing into the downspouts. Birds' nests also cause the blocking of downspouts. All of this rubbish should be removed carefully before the freezing season. In many cases the blocking of downspouts occurs because the diameter of the pipe is too small. To insure the removal of small foreign matter, the diameter should not be less than four or five inches, depending on the normal rainfall in the vicinity.

Steam jets can be inserted at the base of the downspouts to overcome the tendency to freeze. However, although this will keep them free from ice, it is costly with respect to steam consumption and labor. Stovepipes have been placed around downspouts, with spacers to insure that the pipe will be maintained at a uniform distance from the spout. Then, by means of a flexible steam hose, steam is injected at the bottom of the stove pipe, thus heating the downspout and melting the ice inside of it.

It is also possible to apply the open flame from a blow torch to melt the ice inside a heavy metal downspout, but this should be done with a great deal of care, since it involves a hazard of fire being communicated to any adjacent combustible material. It may also involve certain personal hazards. This method is not suitable for sheet metal pipes. If possible to employ it, the steam-jet method will give the best results, besides which there is no fire hazard and less opportunity for personal injury.

Uses a Steam Jet

By General Inspector of Buildings

In northern areas a great deal of trouble is experienced with downspouts, particularly during alternate freezing and thawing weather. At this time they tend to fill up with ice that accumulates first on the inner circumference and then proceeds to grow toward the center of the pipe as fresh water from melting snow or ice on the roof trickles down into the pipe.

As the water freezes it tends to expand and thus exert internal pressure in the downspout to rupture heavy-walled pipe. For this reason it is advisable to make downspouts for cold climates out of heavy corrugated galvanized sheets, which will be flexible enough to allow the ice to expand without rupturing the wall of the pipe. Another precaution that should be taken is that of having the downspouts of sufficient diameter to insure against clogging with ice after every short period of thawing. I would not install a downspout of less than 6 in. in diameter in areas where any troubles from clogging with ice have been experienced, and I prefer 8 in. as the minimum.

Small isolated buildings sometimes present a serious problem with respect to keeping the roof drainage open, not so much because it cannot be done as because of the cost and of the time consumed in getting to and from them. Where there is a concentration of buildings, as at a shop, the cost of attending to the drainage is not so important, since men can be assigned to this work without involving loss of time.

The only way to get rid of ice in a clogged downspout is to melt it, and the easiest and simplest way of melting it is to use a steam jet inside the spout. When a downspout is installed on a building, an inverted Y fitting can be introduced just above the manhole outlet and the jet applied through the otherwise unused leg of the Y, which should have a screwed cap over the opening.

However, since steam is seldom available readily from a fixed boiler-plant, and since the cost of making it available is usually exorbitant, I have on several occasions found it to be of advantage to obtain a small upright boiler which can be mounted on a wheeled frame and hauled from place to place by hand. This boiler, which is fitted with a hose and jet pipe, can be run up to the foot of the clogged downspout and the steam turned into it by way of the Y-fitting. Usually, one man can manage the equipment around a shop or engine-house, although it is better to have two men, and it is really surprising how quickly a downspout can be opened with this device, provided it is ice and not trash causing the trouble.

Getting a Spark

(Continued from page 541)

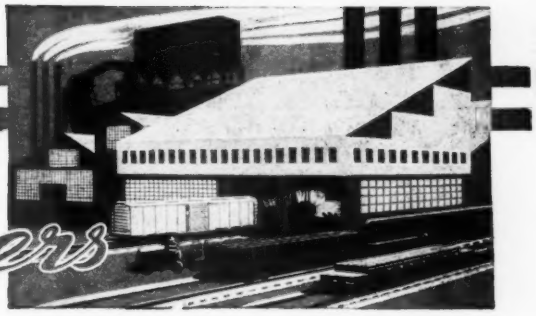
of sparks throughout the time the points are in contact. This requires that the timer controls be adjusted or operated to advance the spark if late timing is to be avoided.

The battery draw of a plain coil such as is commonly sold for use on an automobile engine is considerably greater than that of a vibrator coil. To avoid a heavy drain on the battery, therefore, it is desirable to reduce the time interval during which the points are closed and the current is flowing. The timer can easily be adjusted to give this shorter contact, especially if the contour of the timer rubbing block is made more pointed or cam-like. With these changes, battery life with plain-coil ignition has been found to compare favorably with that where the vibrator coil is used; indeed, some maintainers have reported increased battery life. This is perhaps due to the fact that too often vibrator points are out of adjustment because of the operator's efforts to produce a louder buzz.

The improper adjustment of vibrator points has always been the cause of much poor operation and the source of considerable maintenance expense. The elimination of these two unfavorable conditions is not the only advantage in the use of plain-coil ignition. The cost of the coil itself is considerably less than that of a vibrator coil, and it requires no maintenance. It also appears that because of more accurate timing there is less tendency for the engine to miss firing at high speeds, or to overheat on a heavy pull at low speed.

In the service tests now being made, the coils used are a type sold commercially for use on automobile engines. It is possible that a coil especially designed for motor car use may be developed and give even better results. The tests made thus far cannot be considered to be conclusive; but the results have been so favorable as to warrant mention of the system in this discussion of dry-cell ignition.

PRODUCTS of Manufacturers



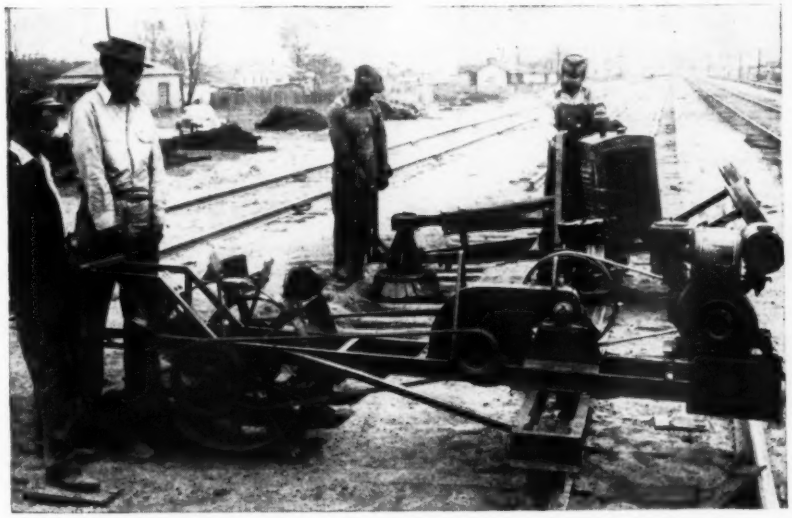
Cribbing Machine

THE Kershaw Company, Inc., Montgomery, Ala., has developed a machine for cleaning ballast out of tie cribs in advance of the adzing machines in rail-laying work. This machine was referred to briefly in an article in the March, 1946, issue of *Railway Engineering and Maintenance*, which described the use of power equipment in track rehabilitation work on the Atlantic Coast Line. Since then, the machine has been further developed and improved and, in addition to its use in connection with tie adzers, is also offered as a means of cribbing track in preparation for surfacing and tie-renewal operations.

In rail-relaying work, the cribbing machine is mounted on one rail and, with the opposite rail removed, displaces the ballast from between the ties at the location of the removed rail to an approximate depth of three inches below top of tie. It is claimed that the cribber, using one man as operator and another to push it along the rails, has cleaned the ballast from one side of as much as 6,000 ft. of track in one day. Essentially, the machine, weighing approximately 1,000 lb., consists of a channel-steel transverse arm, bolted and braced to a base frame mounted on two eight-inch, double-flanged wheels. The transverse arm supports a digging wheel at one end, an engine at the other and reduction pulleys in between. The digging wheel, 40 in. in diameter and having 12 tempered steel teeth, revolves at approximately 75 r.p.m. and displaces the ballast outward. Brushes, fastened to another wheel on the same shaft, sweep the adjacent tie preparatory to the adzing operation.

Power for the cribber is furnished by a 6.1-hp. single-cylinder, air-cooled gasoline engine by means of a clutch and a series of pulleys and belt and roller-chain drives. The belt drives permit slippage in the event that the digging wheel encounters a large rock, or other obstruction, and avoids damage to the machine. If desired, a 46-in. digging wheel may be used instead of the smaller standard wheel, and in this event a 9.1-hp. engine is used for power. A detachable arm with a roller is provided with the machine to facilitate moving it on the track to and from the work site.

It is claimed that tie renewals can be facilitated by using three cribbing machines equipped with 46-in. digging wheels to strip the cribs of ballast directly behind the rail-laying work. This is accomplished in five operations, the first of which, timed immediately after removal of the rail and the plates, is the removal of the ballast from the center of the track by one machine having the transverse arm and digging wheel adjusted accordingly. The second operation follows immediately with another machine removing the ballast from the crib area under the removed rail. After the new rail is laid and spiked, the next operation is performed by the third machine which has the digging wheel adjusted to remove the ballast from the ends of the ties and the shoulders. After one side has been stripped, the procedure is reversed for the other side, that is, in the fourth operation the area under the second rail is cleaned, while in the fifth step the shoulder ballast is removed. A small portion of the ballast remains in the crib where the digging wheel arcs meet and this ballast is said to maintain the track in position until the tie renewals have been made and the cribs refilled.



The Cribbing Machine in Operation with Adzer Following

Close-up of the Digging and Sweeping Wheels of the Machine

Changes in Railway Personnel

General

W. H. Kyle, superintendent of the Montreal terminals and the St. Jerome division of the Canadian National, at Montreal, Que., and an engineer by training and experience, has been promoted to general superintendent of the Northern Ontario district, with headquarters at North Bay, Ont.

Bernard S. Sines, assistant superintendent of the Tucson division of the Southern Pacific, at Tucson, Ariz., and an engineer by training and experience, has been promoted to superintendent of the Salt Lake division, with headquarters at Ogden, Utah.

George J. Ray, vice-president of operations of the Delaware, Lackawanna & Western, who during his service some years ago as chief engineer of that road was responsible for many outstanding improvements, retired from active service on April 1.

Engineering

J. R. Menard has been appointed assistant division engineer on the Canadian National, at Levis, Que.

J. C. Jacobs, division engineer on the Illinois Central, at Water Valley, Miss., has been transferred to Jackson, Tenn.

William T. Elmes, who recently returned from military service and was appointed roadmaster on the Pittsburgh & Lake Erie, at Pittsburgh, Pa., has been promoted to research engineer, with the same headquarters.

W. F. Petteys, recently released from the armed forces, has returned to the Erie as division engineer of the Marion division, with headquarters at Huntington, Ind.

R. M. Fraley, assistant division engineer on the Chicago, Milwaukee, St. Paul & Pacific, at La Crosse, Wis., has been appointed assistant industrial engineer, with headquarters at Minneapolis, Minn.

J. B. Whiting, division engineer on the Chicago, Rock Island & Pacific, at Des Moines, Iowa, has been appointed assistant engineer, with headquarters at Chicago.

J. M. MacBride, assistant engineer on the Canadian Pacific, has been appointed assistant engineer of track, with headquarters as before at Montreal, Que.

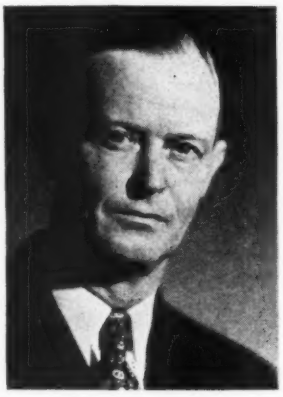
J. A. Danforth, principal engineering assistant in the office of the chief engineer of the Kansas City Southern, at Shreveport, La., has been appointed special engineer on the Illinois Central, with headquarters at Chicago.

Charles C. Stelling, recently released from the armed forces, has been appointed principal assistant engineer on the Georgia & Florida, with headquarters at Augusta, Ga., and under the direction of the chief engineer will have supervision of all engineering and maintenance forces.

E. M. French, supervisor of track on the Buffalo division of the Pennsylvania, at Buffalo, N. Y., has been appointed engineer in charge of a construction project, with headquarters at Pittsburgh, Pa., reporting to the chief engineer.

E. W. Scott, assistant division engineer of the Buffalo and Rochester divisions of the Erie at Buffalo, N.Y., has been appointed track supervisor at Campbell Hall, N. Y., succeeding **Malcolm Condon,** who has been appointed general foreman at Croxton, N.J.

B. H. Crosland, whose appointment as assistant chief engineer of the St. Louis-San Francisco, with headquarters at Springfield, Mo., was reported in the April issue, was born at Rochester, N. Y., on July 9, 1891, and received his higher education at Valparaiso University. He entered railroad service during school vacation in 1908, as a chainman on the Canadian Pacific, and served during subsequent summers as chainman and rodman on several railroads, including the Buffalo, Rochester & Pittsburgh (now part of the Baltimore & Ohio). From 1914 to 1917 he was an instrumentman on railway valuation for the Interstate Commerce Commission. Released from the armed forces in 1919, Mr. Crosland returned to the I.C.C. as senior civil engineer on railway valuation. In 1920 he entered the service of the St. Louis-San Francisco as an instrumentman, and served subsequently as assistant engineer, roadmaster, assistant division engineer and division engineer, until 1942, when he entered the service of the armed forces, in which he attained the rank of colonel.



B. H. Crosland

Don Collis, an assistant engineer on the Bruce division of the Canadian Pacific, at Toronto, Ont., has been transferred to the New Brunswick district, with headquarters at Saint John, N.B., succeeding **G. W. Griffin,** whose promotion to assistant division engineer at Toronto was reported in the April issue.

R. E. Nottingham, assistant engineer on the Louisville & Nashville, at Louisville, Ky., has been promoted to division engineer, with headquarters at Nashville, Tenn., succeeding **A. T. Kinne,** who has resigned.

The **Southern** has announced that the titles of roadmaster and assistant roadmaster on all divisions and lines comprising the Southern Railway System have been changed to division engineer and assistant division engineer, respectively, and the positions of roadmaster and assistant roadmaster abolished.

R. L. McDaniel has been appointed assistant division engineer on the Atchison, Topeka & Santa Fe, with headquarters at San Bernardino, Cal., replacing **L. C. Post,** assigned to other duties. The position of assistant division engineer at San Diego, Cal., formerly held by **N. A. Richards,** has been abolished.

W. E. Free, draftsman in the office of the chief engineer of the Atlantic Coast Line, at Wilmington, N.C., has been promoted to division engineer of the Southern division, with headquarters at Jacksonville, Fla., succeeding **L. E. Bates,** whose appointment as roadmaster at Wilmington is reported elsewhere in these columns.

Louis Rossman, who has recently returned from military service, has been appointed division engineer of the Wyoming and Jefferson division of the Erie, with headquarters at Dunmore, Pa., succeeding **Arthur Price,** who has been appointed assistant division engineer of the Buffalo and Rochester divisions at Buffalo, N.Y. Mr. Price relieves **E. W. Scott,** whose appointment as track supervisor is reported elsewhere in these columns.

O. A. C. Thorsen, assistant chief engineer of the New York, Susquehanna & Western, has been appointed chief engineer, with headquarters as before at Paterson, N.J., relieving **F. C. Kronauer** of the responsibilities of that office so that he may devote his time to his duties as general manager in charge of operations. Mr. Kronauer's appointment as general manager was noted in the August, 1945, issue.

A. O. Wolff, district engineer of the New Brunswick district of the Canadian Pacific at St. John, N.B., has been promoted to assistant engineer, maintenance of way, Eastern Lines, with headquarters at Toronto, Ont., and **J. A. MacKenzie,** assistant engineer, maintenance of way, at Toronto, has been appointed district engineer at St. John, succeeding Mr. Wolff. **G. W. Miller,** also assistant engineer, maintenance of way, at Toronto, has been appointed district engineer, Ontario district, with the same headquarters, relieving **T. B. Ballantyne,** who has been assigned to special engineering duties in the Toronto area.

H. A. Aalberg, assistant chief engineer on the Chicago, Burlington & Quincy, Western Lines, at Lincoln, Neb., has been promoted to assistant chief engineer of

the Burlington System, with headquarters at Chicago, including the Colorado & Southern, the Ft. Worth & Denver City, and the Wichita Valley, succeeding **G. A. Haggander,** whose death is reported elsewhere in these columns. **Chauncey R. Robnett,** hydraulic engineer at Chicago, has been promoted to assistant chief engineer, Western Lines at Lincoln, replacing Mr. Aalberg. A photo of Mr. Robnett and a sketch of his career appeared in the issue of December, 1945.

John W. Demcoe, whose appointment as engineer maintenance of way of the Canadian National at Toronto, Ont., was

John W. Demcoe

announced in the March issue, was born at Kenora, Ont., and was graduated from the University of Manitoba (B. S. civil engineering) in 1939. He entered railway service with the Canadian National in August, 1939, as a structural draftsman at Toronto, Ont., advancing to instrumentman a year later. In November, 1942, he was promoted to assistant engineer, then went to London, Ont., as assistant division engineer in February, 1944. He returned to Toronto as division engineer in May, 1945, maintaining this position until his advancement to engineer maintenance of way became effective on January 23.

R. A. Emerson, assistant district engineer on the Canadian Pacific, at Vancouver, B.C., has been promoted to district engineer, with the same headquarters, succeeding **Thomas Lees,** who has retired. **T. W. Creighton,** division engineer at Revelstoke, B.C., succeeds Mr. Emerson as assisant district engineer at Vancouver. **V. H. Carruthers,** division engineer at Edmonton, Alta., has been transferred to Revelstoke, where he replaces Mr. Creighton.

Clarence C. Lathey, whose promotion to assistant division engineer of the Syracuse division of the New York Central, with headquarters at Syracuse, N.Y., was reported in the February issue, was born in Chicago on April 27, 1902, and was graduated in civil engineering from Queens University (Ontario) in 1925. He entered railway service on July 13, 1925, as a chainman on the New York Central. Six months later he was promoted to rodman on the Adirondack division at Utica, N. Y., and in May, 1927, he was advanced to transitman at that point. From 1932 to 1935, Mr. Lathey held various jobs in the bridge and building department on the Mohawk division, and in November, 1935, he was appointed assistant foreman of the iron gang at Albany, N.Y. On June 15, 1936, he was appointed a draftsman in the office of the engineer maintenance of way at New York, and on November 1, 1937, he was appointed assistant supervisor of track at Fonda, N.Y. Mr. Lathey was advanced to acting supervisor of track at Selkirk, N.Y., on December 1, 1940, and to assistant engineer on the Electric division at New York on July 1, 1942. On June 21, 1943, he was promoted to assistant division engineer of the Electric division, and on May 1, 1944, he was appointed supervisor of track at Jersey Shore, Pa., which position he held until his recent promotion, effective January 1.

George A. Calhoun, whose promotion to division engineer on the Seaboard Air Line, at Tampa, Fla., was reported in the February issue, was born at Marianna, Fla., on March 3, 1902, and was graduated in electrical engineering from the University of Florida in 1924. After working on private survey work in Florida, he entered railway service on May 10, 1926, with the

George A. Calhoun

Seaboard as assistant to the division engineer at Arcadia, Fla. In October, 1927, he was appointed apprentice track foreman at Arcadia and three months later he obtained a leave of absence to engage in special engineering work at Macon, Ga., and Atlanta. He returned to the Seaboard in June, 1928, as assistant to the division engineer at Atlanta, and two years later was appointed assistant extra gang foreman on the Georgia division. Mr. Calhoun was re-appointed assistant to the division engineer at Atlanta in January, 1931, and in June, 1933, was promoted to assistant division engineer at that point. In October, 1937, he was transferred to Jacksonville, Fla., and later served successively as assistant master carpenter and assistant division engineer there, holding the latter position at the time of his recent promotion.

C. B. Terrell, senior instrumentman on the Cincinnati division of the Louisville & Nashville, has been appointed assistant engineer on the same division, with headquarters as before at Latonia, Ky., succeeding **R. B. Lindsey,** who has been transferred to the Knoxville and Atlanta division, with headquarters at Knoxville, Tenn., where he replaces **T. D. Cassady,** who has been appointed assistant track supervisor on the Knoxville and Atlanta division, with headquarters at LaFollette, Tenn.

J. G. Begley, whose promotion to division engineer on the Baltimore & Ohio, at Washington, Ind., was reported in the March issue, was born at Dwale, Ky., on August 14, 1900. He entered railroad

J. G. Begley

service on August 27, 1917, with the Baltimore & Ohio as chainman and rodman, and served in various minor positions on corps until September, 1925, when he was appointed assistant engineer on cost analysist at Baltimore, Md. In October, 1926, he returned to the maintenance of way department as assistant engineer, and was made assistant division engineer in April, 1927, the position he held at the time of his recent promotion.

Ray Stephens, whose appointment as engineer of maintenance of way of the Toledo Terminal was reported in the

Ray Stephens

March issue, was born at Celina, Tenn., on March 3, 1882, and received his technical education at Rose Polytechnic Institute, for which he was graduated as a civil engineer in 1909. He entered railroad service in 1909 with the Pennsylvania and served with that road until

April, 1923, when he resigned as assistant division engineer to enter the service of the Toledo Terminal as engineer, the position he held at the time of his recent appointment.

C. I. Hartsell, whose promotion to division engineer on the Pere Marquette, with headquarters at Saginaw, Mich., was reported in the March issue, was born at Benton Harbor, Mich., on October 17, 1907, received his higher education at Michigan State College, and entered railroad service in August, 1929, as an assistant on the engineer corps of the Penn-

C. I. Hartsell

sylvania, at Grand Rapids, Mich. In April, 1933, he entered the service of the Pere Marquette as a grinder operator, and became a rodman at Saginaw in May, 1934. From November, 1934, to June, 1935, he worked as a welder helper, and in the latter month he returned to the position of rodman. Mr. Hartsell was promoted to instrumentman in June, 1939, with headquarters as before at Saginaw, and served in that capacity until September, 1943, when he was advanced to assistant engineer at the same place, the position he held at the time of his recent promotion.

H. B. Rutherford, whose appointment as assistant division engineer of the Eastern division of the New York Central, with headquarters at New York, was reported in the February issue, and whose transfer to the Pennsylvania division, with headquarters at Jersey Shore, Pa., was reported in the April issue, was born at Madrid, N. Y., on December 27, 1898, and was graduated in civil engineering from Clarkson College of Technology. He entered railway service on July 8, 1921, as a chainman on the New York Central, at Oswego, N.Y., later serving as rodman and transitman at Oswego and Watertown, N.Y. On October 1, 1934, he was appointed assistant supervisor of track at Malone, N.Y., later being transferred successively to Newburgh, N.Y., and Beacon. On January 15, 1943, Mr. Rutherford was advanced to supervisor of track at New York, and on January 1, 1946, he was promoted to assistant division engineer at New York.

F. J. Bishop, whose appointment as chief engineer of the Akron, Canton & Youngstown, with headquarters at Akron, Ohio, was reported in the April issue, was born at Sault Ste. Marie, Mich., on May 27, 1894, and was graduated from the University of Michigan in civil engineering. He entered railway service in 1917 with the Lake Superior & Ishpeming as assistant engineer, then joined the Ann Arbor in 1922 as assistant chief engineer, advancing to engineer maintenance of way and then to chief engineer. He went with the Toledo Terminal Railroad in 1927, serving as engineer—signaling, bridges and buildings until 1933, when he was appointed engineer maintenance of way. Mr. Bishop held the latter post until his appointment as chief engineer of the Akron, Canton & Youngstown, effective on February 18.

Track

R. Hope, roadmaster on the Canadian National at Lindsay, Ont., retired recently.

Sam Rimstad, roadmaster on the Canadian Pacific, at Kenora, Ont., has retired.

Joseph J. Westerhaus, roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Newton, Kan., has retired.

T. Roulston, roadmaster on the Canadian Pacific, at Regina, Sask., has retired. **F. Topham,** roadmaster at Mission, B.C., has retired.

H. G. Whittet, Jr., assistant cost engineer on the Chesapeake & Ohio at Hinton, W. Va., has been promoted to assistant supervisor of track of the Northern subdivision of the Cincinnati division.

A. E. Tennant, section foreman on the Canadian National at Clarksons, Ont., has been promoted to roadmaster at Hamilton, Ont., succeeding **J. Carson,** who has been transferred to Toronto, Ont., relieving **A. E. Shirley,** transferred.

R. E. Vandivort, inspecting engineer of the Pittsburgh & Lake Erie, at Pittsburgh, Pa., has been appointed roadmaster, with the same headquarters, succeeding **William T. Elmes,** whose appointment as research engineer is reported elsewhere in these columns.

William Baerthlein, who has recently returned from military service, and who was formerly a transitman on the Eastern division of the New York Central, has been appointed assistant supervisor of track, subdivision No. 30, Buffalo division, with headquarters at Rochester, N. Y., succeeding **Wolters Ledyard,** assigned to other duties.

Marvin R. Tanner, whose promotion to supervisor of track on the Central of Georgia, at Macon, Ga., was reported in the February issue, was born at Macon on November 29, 1908, and entered railway service on May 7, 1927, as an assistant rail welder on the Macon division of the Central of Georgia. On February 1, 1934, he was advanced to welder on the Savannah division, the position he held until his recent promotion.

G. W. Mills, roadmaster on the Atlantic Coast Line, at Petersburg, Va., has been transferred to Parmele, N.C., succeeding **C. Fowler,** assigned to other duties. **C. J. Elliston,** roadmaster at Rocky Mount, N. C., has been transferred to Petersburg, replacing Mr. Mills, and **G. W. Knight,** acting roadmaster, has been promoted to roadmaster at Rocky Mount. **I. M. Boone,** acting roadmaster at Goldsboro, N.C., has been advanced to roadmaster at that point. **L. E. Bates,** division engineer at Jacksonville, Fla., has been appointed roadmaster of the Wilmington (N.C.) district, succeeding **G. B. Copeland,** whose death on January 17 was reported in the March issue.

J. E. Rogan, Jr., supervisor of track on the Illinois Central at Mendenhall, Miss., has been transferred to McComb, Miss., where he replaces **S. P. Critz,** whose promotion to supervisor of bridges and buildings is noted elsewhere in these columns. **B. Williamson,** general foreman of track at Paducah, Ky., succeeds Mr. Rogan as supervisor at Mendenhall.

Leo T. Hogan has been appointed roadmaster on the Chicago, St. Paul, Minneapolis & Omaha, at Mankato, Minn., succeeding **H. Schumacher,** deceased. **J. W. Hendrickson** has been appointed roadmaster of subdivision 4, Eastern division, with headquarters at Spooner, Wis., succeeding **E. Rezarch,** who has retired. **Albert Trautman** has been appointed assistant roadmaster of subdivision 2, Western division, with headquarters at Worthington, Minn., succeeding Mr. Hogan. **Frank Stotka** has been appointed assistant roadmaster of subdivision 2, Eastern division, with headquarters at St. Paul, Minn., succeeding Mr. Hendrickson.

H. W. Moore, whose promotion to roadmaster on the Atlantic Coast Line at Trilby, Fla., was reported in the February issue, entered railway service as a section laborer on the Coast Line on March 1, 1923, and was promoted to apprentice foreman on June 1, 1924, later serving as a relief foreman on section, yard and extra gang assignments. Mr. Moore was advanced to section foreman on November 1, 1925, and later operated various types of roadway equipment in construction work. In 1943 he served as relief roadmaster for eight months at Trilby and Sanford, Fla., and on July 15, 1945, he was appointed acting roadmaster at Sanford, which position he held until his recent promotion.

W. W. Worthington, assistant supervisor of track on the Maryland division of the Pennsylvania, at Washington, D.C., has been promoted to supervisor of track at Wheeling, W. Va., succeeding **J. J. Stiles,** who has been transferred to the Cleveland division, with headquarters at Cleveland, Ohio, where he replaces **C. F. Grigg,** who has resigned. **T. E. Ralston,** assistant on the engineering corps at Trafford, Pa., succeeds Mr. Worthington as assistant supervisor of track at Washington. **H. A. Spruill,** assistant supervisor of track at Altoona, Pa., has been promoted to supervisor of track at Northumberland, Pa., succeeding **A. D. Kerr,** who has been transferred to Freedom, Pa. **E. M. Hodges,** assistant supervisor of track at Aspinwall, Pa., succeeds Mr. Spruill at Altoona, and **R. H. Smith, Jr.,** assistant on the engineering corps at Trenton, N. J.,

(Continued on page 554)

succeeds Mr. Hodges as assistant supervisor of track at Aspinwall. **D. E. Pergrin,** assistant on the engineering corps at Harrisburg, Pa., becomes assistant supervisor of track at Freedom, Pa., succeeding **Walter L. Turner, Jr.,** resigned. **A. K. Howe,** supervisor of track at Dunkirk, N. Y., has been transferred to Cincinnati, Ohio, replacing **P. O. Hansen,** who has resigned. **H. C. Kohout,** recently released from the armed forces and formerly assistant supervisor of track on the Panhandle division, succeeds Mr. Howe at Dunkirk. **D. C. Hastings,** recently released from the armed forces and formerly assistant supervisor of track on the Eastern division, has been appointed supervisor of track on the Buffalo division at Buffalo, N. Y., succeeding **E. M. French,** whose appointment as engineer in charge, office of the chief engineer, with headquarters at Pittsburgh, Pa., is reported elsewhere in these columns.

William D. Hart, whose promotion to roadmaster on the Atlantic Coast Line, with headquarters at Troy, Ala., was reported in the February issue, was born at Ludowici, Ga., on March 21, 1891, and entered railway service on December 15, 1905, as a laborer on the Georgia Coast & Piedmont (now abandoned), later serving as an apprentice foreman. On August 1, 1909, he was advanced to section foreman, and on June 14, 1918, he enlisted in the U.S. Army. Mr. Hart returned to the G.C.&P. as a foreman on December 11, 1918, and on October 1, 1919, he went with the Atlantic Coast Line as an assistant bridge gang foreman. On March 1, 1920, he was advanced to extra-gang foreman, later serving successively as ditcher train foreman and yard foreman at Montgomery, Ala. On February 16, 1945, he was promoted to acting roadmaster at Troy, Ala., which position he held until his recent promotion.

George O. Graham, whose promotion to roadmaster on the Chicago, Burlington & Quincy, at Red Oak, Iowa, was reported in the February issue, was born at Emerson, Iowa, on September 27, 1904, and was educated in the high schools of that city and through the International Correspondence Schools. He entered railway service on August 1, 1923, as a section laborer on the Burlington, advancing to section foreman at Hastings, Iowa, in 1927. He subsequently served in that capacity at Villisca, Iowa, Council Bluffs and Emerson. In April, 1938, he was promoted to track supervisor at Villisca, later serving as acting roadmaster, assistant roadmaster and track supervisor at various points on the Creston division. Mr. Graham was appointed acting roadmaster at Creston in April, 1945, holding this position until his recent promotion.

Thomas L. Kanan, whose promotion to roadmaster-assistant master carpenter on the Chicago, Burlington & Quincy, at Kansas City, Mo., was reported in the February issue, was born at Cameron, Mo., on August 18, 1907, and received his higher education at Missouri Wesleyan College in that city. He entered railway service in May, 1922, as an extra-gang laborer on the Burlington at Lacelede, Mo., working during summer vacations until 1930. In 1925, he was promoted to assistant extra-gang foreman at Holt, Mo., and the following year he was further advanced to extra-gang foreman at Cameron, later serving as section foreman at various points. In April, 1932, Mr. Kanan was promoted to track supervisor at Hannibal, Mo., and in August, 1944, he was further advanced to assistant roadmaster at West Alton, Mo., holding this position until his recent promotion.

Curtis Van Velkinburgh, whose promotion to roadmaster on the Chicago, Burlington & Quincy, at Creston, Iowa, was reported in the February issue, was born at New Hampton, Mo., on December 27, 1900, and entered railway service on March 1, 1916, as a section laborer on the Burlington at that point. In 1919 he was promoted to extra section foreman on the St. Joseph division and two years later he was further advanced to section foreman, later transferring to the Hannibal division. In 1932 he was advanced to track supervisor on that division. Mr. Van Velkinburgh was promoted to acting roadmaster at Kansas City, Mo., on April 5, 1945, holding this position until his recent appointment.

Special

J. R. Armstrong, recently returned from service in the U.S. Navy, has been appointed assistant chief tie and lumber supervisor of the Atlantic Coast Line, with headquarters at Wilmington, N.C.

John Foley, forester of the Pennsylvania, with headquarters at Philadelphia, Pa., has retired after nearly 40 years of railroad service, all with the Pennsylvania.

Bridge and Building

G. R. Webber, bridge and building foreman on the Idaho division of the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to chief carpenter, with headquarters at Spokane, Wash.

George A. Brown, general foreman bridges and buildings, on the Atchison, Topeka & Santa Fe, at Slaton, Tex., has been transferred to Wellington, Kan., where he replaces **J. O. Butler,** who has retired. **C. L. Panner,** office engineer at Clovis, N.M., has been appointed general foreman, bridges and buildings, at Slaton, succeeding Mr. Brown.

Clifford Sathre has been appointed supervisor of bridges and buildings on the Chicago & North Western, with headquarters at Norfolk, Neb., succeeding **Herman Heiszenbuttel,** who has retired. **G. C. Johnson,** bridge and building foreman at Escanaba, Mich., has been promoted to assistant supervisor of bridges and buildings at West Chicago, succeeding Mr. Sathre.

John Galbraith, bridge and building inspector on the Electric division of the New York Central, at New York, has been promoted to assistant supervisor of bridges and buildings of the Syracuse division, with headquarters at Rochester, N. Y., succeeding **William Cavanaugh,** who retired from active service on April 15.

L. S. Marriott, supervisor of bridges and buildings on the Louisiana division of the Illinois Central, at McComb, Miss., has been promoted to general building inspector at Chicago, succeeding **R. A. Blake,** who has retired.

S. P. Critz, supervisor of track on the Illinois Central, at McComb, Miss., has been promoted to supervisor of bridges and buildings on the Louisiana division, with the same headquarters, succeeding **L. S. Marriott,** whose promotion to general building inspector at Chicago is reported elsewhere in these columns.

D. H. Johnson has been appointed acting supervisor of bridges and buildings on the Eastern division of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at Spooner, Wis., replacing **C. Sedmiradski,** who has been granted a leave of absence on account of illness. **J. A. Bracht** has been appointed acting supervisor of bridges and buildings on the Western division, with headquarters at Sioux City, Iowa, succeeding Mr. Johnson.

Obituary

H. C. Miracle, assistant roadmaster on the Chicago & North Western, died suddenly at Mayfair, Ill., on April 22.

Charles C. Kirby, who retired in 1940 as district engineer on the Canadian Pacific, at St. John, N.B., died recently in that city.

Edward G. Taber, who retired in 1932 as chief engineer of the Spokane International, died at Spokane, Wash., on February 19.

G. A. Haggander, who retired on April 1 as assistant chief engineer of the Burlington Lines, with headquarters at Chicago, died at his home in La Grange, Ill., on April 14.

F. E. Weise, who retired in December 1943, as chief clerk to the chief engineer of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Chicago, died at a hospital in that city on April 15, as a result of injuries sustained in a traffic accident on April 1. Born in 1868, he served on the Milwaukee for 54 years. Mr. Weise was president of the American Railway Bridge and Building Association in 1920, and treasurer from 1941 to 1943. At the annual meeting of the association in October, 1943, he was elected treasurer emeritus.

Bridge and Building Maintenance Handbook—The Stonhard Company, Philadephia, Pa., has published a 16-page, illustrated Railroad Bridge and Building Maintenance Handbook, which includes information on such railroad bridge and building maintenance problems as waterproofing below-grade pits, leakproofing water tanks, rustproofing bridges, roof preservation, platform hardening and patching, and other similar problems.

(Continued on page 556)

To Speed-Up Freight

GREAT NORTHERN USES 5,400 HORSEPOWER DIESEL LOCOMOTIVES

TO SPEED TIE RENEWALS

They use WOOLERY TIE CUTTERS

Hauling heavier freight trains faster is the important task of Great Northern's 5,400 horsepower diesel locomotives. Helping to complete tie renewal programs ahead of schedule is the daily work of WOOLERY TIE CUTTERS.

Tie replacement time, labor and cost are greatly reduced with the use of Woolery Tie Cutters. Two cuts, just inside the rail, are made in the tie with about 20 to 30 seconds required for each cut. The end sections of the tie are easily pried out with a bar, while the center section is removed by lifting out from between the rails. This results in minimum disturbance to the tie bed.

The blade of the Woolery Tie Cutter operates with a reciprocating motion and can make from 50 to 100 cuts before sharpening is necessary.

Hundreds of Woolery Tie Cutters being used by the railroads in America are helping them save up to 30% in tie renewal costs.

WOOLERY MAINTENANCE EQUIPMENT

TIE CUTTERS WEED BURNERS CREOSOTE SPRAYERS

Available in 5-Burner, 3-Burner, 2-Burner and 1-Burner Models

WOOLERY MACHINE COMPANY

MINNEAPOLIS — Pioneer Manufacturers of — MINNESOTA

RAILWAY MAINTENANCE EQUIPMENT

RAILWAY WEED BURNERS • MOTOR CARS • TIE CUTTERS • TIE SCORING MACHINES • RAIL JOINT OILERS • CREOSOTE SPRAYERS • BOLT TIGHTENERS

Association News

Railway Tie Association

The association will hold its twenty-eighth annual convention at the Netherland-Plaza Hotel, Cincinnati, Ohio, May 28-29.

Metropolitan Maintenance of Way Club

The annual meeting of the Metropolitan Maintenance of Way Club was held on April 25 at the Hotel Sheraton, New York. The speaker at this meeting was C. B. Bronson, inspecting engineer, New York Central System, who addressed the club on "Recent Developments in Rail Design and Metallurgy."

Bridge and Building Association

All eight technical committees of the association have their work well under way, looking to the annual meeting of the association in Chicago September 17-19, concurrent with, but independent of, the annual meeting of the Roadmasters' Association and a joint exhibit of the Track Supply Association and the Bridge and Building Supply Men's Association. Late in April all members received a copy of the Bridge and Building News, outlining the plans for the convention and urging members to make early arrangements to attend.

The executive committee of the association will meet in Chicago on July 8 to review all of the technical reports now in preparation for presentation at the annual meeting, and to complete the program for that meeting.

Maintenance of Way Club of Chicago

Completing one of the most successful years in its history, both from the standpoint of attendance and growth in membership, the club held its annual meeting in Chicago on April 22. Features of the meeting, which was attended by 190 members and guests, were an informal recepion prior to the meeting proper, the election of officers for the ensuing year, and an address by John P. Kiley, assistant general manager, Chicago, Milwaukee, St. Paul & Pacific, on What Management Expects of the Maintenance of Way Department.

In the election of officers, E. C. Vandenburgh, chief engineer, Chicago & North Western, was advanced from first vice-president to president; Guy P. Palmer, regional engineer construction and maintenance, Baltimore & Ohio, was advanced from second vice-president to first vice-president; W. G. Powrie, engineer maintenance of way, Chicago, Milwaukee, St. Paul & Pacific, was elected second vice-president; C. R. Knowles, superintendent of water service, Illinois Central (retired), was elected secretary-treasurer; and Neal D. Howard, editor, *Railway Engineering and Maintenance*, was elected to the newly-created position of executive secretary. In addition, C. H. Mottier, vice-president and chief engineer, Illinois Central System; John F. Swenson, division engineer, special duty, Pennsylvania; and J. Russell Mooney, manager, rail and fastenings department, Robert W. Hunt Company, were elected directors for a term of two years. The membership of the club at the end of the year was 489, the largest in its history.

American Railway Engineering Association

On April 16 the chairmen or vice-chairmen (and in some cases both) of the association's standing committees met in Chicago with President J. B. Akers to discuss various aspects of the work of the committees for the ensuing year. The subjects discussed included organization and procedure, objectives, the importance of personnel and of revision of the Manual, and the form in which the reports should be prepared. The meeting was attended also by C. H. Mottier, chairman of the Committee on Personnel of Committees and by J. E. Teal, chairman of the Committee on Outline of Work.

Two of the association's committees held meetings during April. The committee on Water Service and Sanitation met at Chicago on April 17 and the Committee on Economics of Railway Labor met at Chicago on April 25. Two committees also plan to hold meetings in May, including the Committee on Records and Accounts, which will meet at Washington on May 13 and 14, and the committee on Iron and Steel Structures which will meet at Urbana, Ill., on May 1 and 2.

Track Supply Association; B.&B. Supply Men's Association

Both of these associations are recouping their memberships following their relative inactivity during the war years and looking forward to the joint exhibit of the associations to be held in the Hotel Stevens, Chicago, September 17-19, concurrent with the annual conventions of the Roadmasters' Association and the American Railway Bridge & Building Association. Inquiries concerning membership in the Track Supply Association should be addressed to Lewis Thomas, Secretary, 59 E. Van Buren St., Chicago, and concerning membership in the B.&B. Supply Men's Association to E. C. Gunther, Secretary, 122 S. Michigan Ave., Chicago 3. Specific inquiries concerning the exhibit, which some believe will be the largest in the history of these associations, should be made direct to Mr. Thomas, who is acting as director of exhibits.

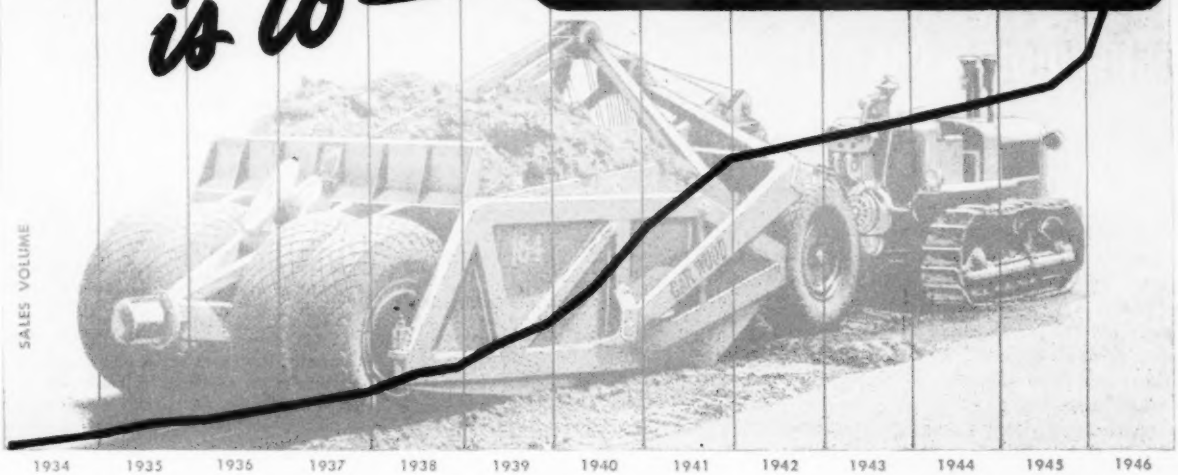
Wood Preservers' Association

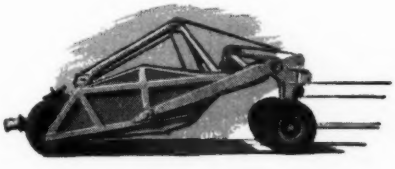
Resuming normal convention activities, the association held its forty-second annual meeting at the Netherland Plaza Hotel, Cincinnati, Ohio, April 23-25. Presided over by J. H. Bremicker, Pennsylvania Railroad, the meeting was divided into four intensive sessions on the morning and afternoon of April 23 and the mornings of April 24 and 25. A feature of the meeting, which included 42 reports and addresses, was the Users' Day program on the morning of the 24th, with 12 reports and addresses, including an ad-

(Continued on page 558)

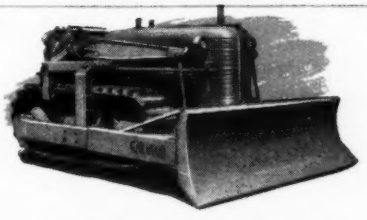
GAR WOOD ROAD MACHINERY
WITH ALLIS-CHALMERS DIESEL POWER

The trend is to—





4-WHEEL CABLE SCRAPERS
Capacities: 11-15-20-25 cu. yds.



HYDRAULIC DOZECASTERS with angling blades, for all Allis-Chalmers Tractors

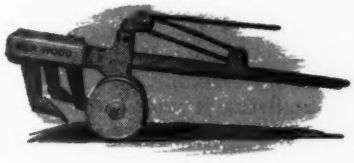
CABLE DOZE-CASTERS with angling blades, for Allis-Chalmers HD-10, HD-14 and HD-14C Tractors

On every kind of earth moving job, throughout the world, Gar Wood Road Machinery has made good, setting new high standards of performance and workmanship.

As a result, the demand for this equipment has steadily grown over a period of many years (see chart above) until now it has reached the proportions of a world-wide trend.

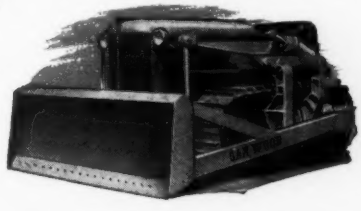
Here is a sound reason for specifying Gar Wood earth moving units. "Nothing succeeds like success."

Contact your Allis-Chalmers dealer. Let him point out the superior features of Gar Wood Road Machinery and show you actual job performance in your territory with many satisfied users.



HEAVY DUTY RIPPERS
Cable and hydraulically operated

2-WHEEL HYDRAULIC SCRAPERS
Capacities: 3-5-6-8 cu. yds.



HYDRAULIC BULLDOZERS with fixed blades, for all Allis-Chalmers Tractors.

GW ROAD MACHINERY is Sold Through ALLIS-CHALMERS

ROAD MACHINERY DIVISION
GAR WOOD INDUSTRIES, Inc.
DETROIT 11 MICHIGAN

OTHER PRODUCTS OF GAR WOOD INDUSTRIES INCLUDE: HOISTS AND BODIES • WINCHES AND CRANES • TANKS • HEATING EQUIPMENT • MOTOR BOATS

dress by J. B. Akers, chief engineer, Southern Railway System, on The Need for Research and Development in the Wood Preserving Industry. Among the reports of particular interest to railway men were those on Handling of Forest Products; Painting of Creosoted Wood; Pressure Treatment of Oak Ties, Lumber and Piles; Pressure Treatment of Gum Ties; Tie Service Records; Uses of Treated Wood for Car Lumber; Pressure Treated Foundation Piles; Fireproofing; An International Termite Exposure Test; and Preservative and Fire Retardant Treatments of Laminated Members.

Roadmasters' Association

The work of organizing committees to investigate and prepare reports on the six subjects chosen for discussion at the 1946 convention has now been completed. The subjects to be reported on, and the chairmen and vice-chairmen of the committees appointed to prepare the reports, follow:

Committee No. 1—Selection and Maintenance of Ballast: R. B. Smith (chairman), asst. trmstr., C.R.I.&P., Dalhart, Tex.; H. W. Kellogg (vice-chairman), div. engr., P.M., Saginaw, Mich.; E. W. Scott (vice-chairman), asst. div. engr., Erie, Buffalo, N.Y.

Committee No. 2—Tie Failures and Measures to Overcome Them: S. H. Shepley (chairman), supvr. trk., E.J.&E., Joliet, Ill.; C. Miles Burpee (vice-chairman), *Railway Age*, Chicago.

Committee No. 3—Inspection of Rail by Track Forces: J. A. Stonebraker (chairman), rdm., A.T. &S.F., Newton, Kan.; Ray Marshall (vice-chairman), rdm., G.N., Superior, Wis.; J. R. Mooney (vice-chairman), Robt. W. Hunt Co., Chicago.

Committee No. 4—Programming Work to Obtain Maximum Use of Power Equipment: A. H. Whisler (chairman), asst. engr., Pennsylvania, Philadelphia, Pa.; G. B. Aydelott (vice-chairman), trmstr.-rdm., D.&R.G.W., Gunnison, Colo.; J. S. Anthony (vice-chairman), trk. supvr., Southern, Gastonia, N.C.

Committee No. 5—Track Maintenance Problems in C.T.C. Territory: G. L. Morrison (chairman), asst. engr. m. of w. & s., S.P., San Francisco, Cal.; I. L. Hopkins (vice-chairman), trk. supvr., A.T.& S.F., San Juan, Capistrano, Cal.; A. B. Chaney (vice-chairman); dist. engr., M.P., (now gerente general, Guayaquil & Quito, Ecuador, S. A.)

Committee No. 6—Minimizing the Need for Slow Orders: J. C. Jacobs (chairman), div. engr., I.C., Jackson, Tenn.; R. E. Meyer (vice-chairman), rdm., C.&N.W., Sterling, Ill.; P. K. Koehler (vice-chairman), asst. supt., C.&O., Peach Creek, W. Va.

The plan is to have the reports completed in time for them to be reviewed and discussed at a meeting of the Executive committee to be held in Chicago July 15.

Supply Trade News

General

The **Whiting Corporation** of Harvey, Ill., has moved its Pittsburgh, Pa., sales office to new and larger quarters in the Pitt Bank Building at Fifth and Liberty avenues.

Personal

J. T. Myers has been appointed assistant general manager of the **Davey Compressor Company,** Kent, Ohio. Mr. Myers, who received his engineering training at Duke University, has just been released from the Navy with the rank of lieutenant. During his service in the armed forces, he served as engineering officer on a minesweeper and later as an experimental engineer, assigned to the Naval Academy at Annapolis, Md. Mr. Myers first joined the Davey Compressor Company in 1941.

Charles E. Heintz, general sales manager of the **Elastic Stop Nut Corporation of America,** Union, N. J., has been elected vice-president in charge of sales.

P. A. Alers has been appointed manager of the El Paso, Tex., office of the Worthington Pump & Machinery Corporation.

Carlton P. Ross, recently released from the armed forces, has been appointed sales representative of the **Ross & White Co.,** Chicago.

R. J. Dervey, recently released from the armed forces, has been placed in charge of the Pittsburgh, Pa., office of the **American Hoist & Derrick Co.,** relieving **Ralph Thomson,** who becomes manager of the New York office.

C. H. Jones, a chief clerk of the **Texas Company,** has been appointed assistant to the traffic manager at New York, **J. J. Roby,** also a chief clerk, has been appointed representative, western district, Chicago.

Effective January 1, **W. D. Hoffman** was appointed engineer, with headquarters at Philadelphia, Pa., for the **Railway Track-Work Company,** to succeed to the duties of the late A. M. Nardini, vice-president, who died on October 19 at the age of 63. Mr. Hoffman formerly was an instructor with the Oxweld Railroad Service Company.

The Levitt Safety Appliances Company, Toronto, Ont., Can., has been appointed a distributor in the provinces of Ontario and Quebec, for the line of dry chemical fire extinguishers of the **Ansul Chemical Company,** Fire Extinguishers division, Marinette, Wis.

Dan K. Heiple, recently released from the armed forces, has returned to **R. G. LeTourneau, Inc.,** Peoria, Ill., as a field engineer in the installation department, which provides consultation service for the owners and users of heavy earth-moving equipment.

C. A. Matheny has been appointed director of the newly-formed manufacturing development division of the **Caterpiller Tractor Company,** Peoria, Ill. Prior to his new appointment, Mr. Matheny served as a factory superintendent at the Peoria plant, and as works manager of the Caterpillar Military Engine Company.

Clinton E. Stryker, formerly vice-president and assistant to the president of the Nordberg Manufacturing Company, Milwaukee, Wis., has resigned to become president and general manager of the **Adel Precision Products Corporation,** with headquarters at Burbank, Cal.

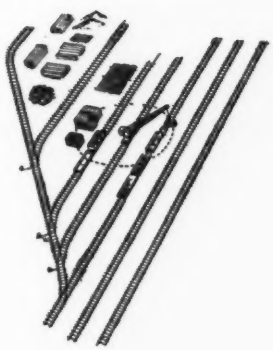
Oscar W. Nelson has been appointed vice-president and general manager of the Peoria, Ill., plant of **R. G. LeTourneau, Inc.** He formerly was general manager of the Beaver, Pa., plant of the

(Continued on page 560)

• The new "American" Diesel-Electric Locomotive Crane brings new standards of efficiency to a railroad's storing and stock handling operations.

Its extreme efficiency and convenience make shipping by rail more attractive than ever! It provides the ideal private switching engine AND gives perfect flexibility to magnet, bucket and hook work of all types. Fast, smooth, steady, low-cost materials handling . . . streamlined, easy operation, winter and summer . . . extremely low maintenance . . . all are assured.

Get the performance facts! Individually designed Diesel, gasoline or steam models of "American" Locomotive Cranes are also available.



AMERICAN
HOIST & DERRICK CO.

St. Paul 1, Minnesota

CHICAGO NEW YORK SAN FRANCISCO

REVOLVERS LOCOMOTIVE CRANES HOISTS DERRICKS BLOCKS AND SHEAVES CROSBY CLIPS

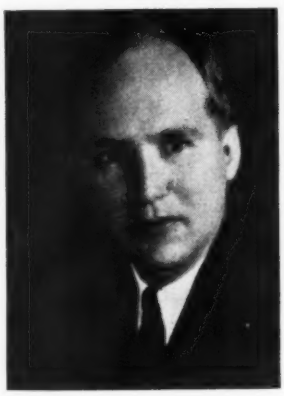
propeller division of the Curtiss Wright Corporation. He will be in charge of all Peoria operations, including those formerly handled by **Denn M. Burgess,** who recently resigned as executive vice-president and director.

George E. Gates has been appointed a member of the staff of the Worthington-Ransome Construction Equipment division of the **Worthington Pump & Machinery Corporation,** with headquarters at San Francisco, Cal.

Richard F. Garretson, recently released from the armed forces, has been appointed eastern regional manager of the **Ransome Machinery Company,** Dunellen, N.J., a subsidiary of the Worthington Pump & Machinery Corporation, with headquarters at 2905 North Broad Street, Philadelphia.

The Rust-Oleum Corporation, Evanston, Ill., has announced the appointment of three new general agents in the railway supply field: **W. E. Bugbee,** Alamo National Building, San Antonio, Tex.; **W. D. Jenkins,** 1317 Praetorian Building, Dallas, Tex.; and **F. M. Sweeney,** 4136 Roland Avenue, Baltimore, Md.

Fairbanks, Morse & Co., Chicago, has consolidated its Diesel locomotive and railroad divisions. **John W. Barriger, III,** who has been manager of the Diesel locomotive division, has been appointed manager of the combined railroad division and **John S. King,** acting manager of the railroad division, has been appointed assistant manager. **V. H. Peterson,** formerly assistant to the president and manager of the New York office of the Baldwin Locomotive Works, has been appointed manager of railroad sales, eastern division of the company with offices in New York.



John W. Barriger, III

Mr. Barriger was born in Texas and is a graduate of the Massachusetts Institute of Technology. He began his career with the Pennsylvania, serving in various capacities in the maintenance of way and the transportation departments. From 1933 to 1941 he was in charge of the Railroad division of the Reconstruction Finance Corporation and in the latter year he became associated with the Carriers' Conference committee, working on the 1941 wage case. At its conclusion Mr. Barriger returned to Washington, D.C., as an associate director of the Office of Defense Transportation, resigning from that position to again become associated with the Carriers' Conference committee in the 1943 wage case, and also to become vice-president of the Union Stock & Transit Co., Chicago. From 1940 to 1942 he was appointed reorganization manager of the Chicago & Eastern Illinois and during this period he was elected to the board of directors. He subsequently became a member of the board of the Alton.

General Brehon B. Somervell, commander of the Army Service Forces during World War II, has been elected president of the **Koppers Company. J. P. Williams,** who has served as chairman of the board and president since October, 1944, will continue to serve as chairman and chief executive officer.

C. E. Jones, recently released from the armed forces, has been appointed sales development manager of the **Caterpillar Tractor Co.,** Peoria, Ill., succeeding **K. F. Park,** whose appointment as engineering consultant on all matters pertaining to the earthmoving field was reported in the April issue. Mr. Jones has served with county and state highway departments, J. D. Adams Co., and the International Harvester Co. During the war Mr. Jones was assigned to Peoria and charged with procuring Caterpillar products for the Corps of Engineers.

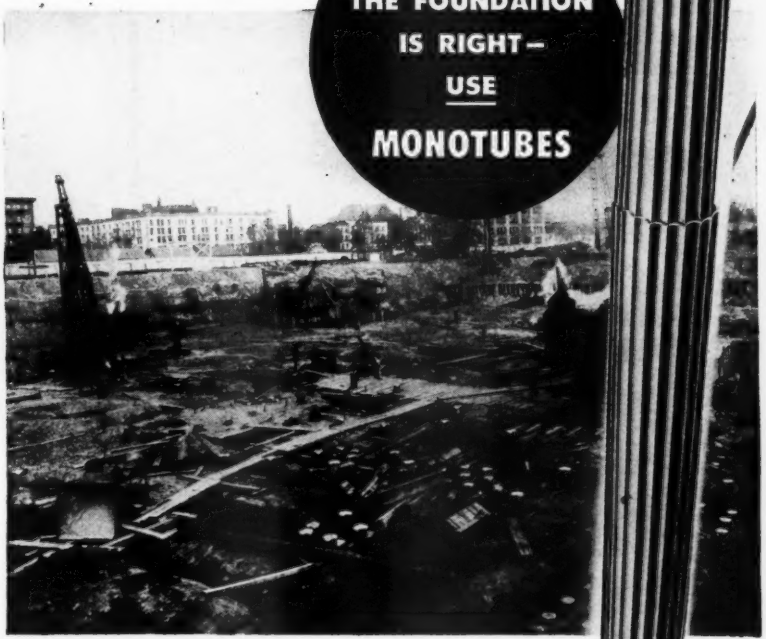
C. D. Fey, formerly with the sales, purchasing and special products departments of the Caterpiller Tractor Company, and **J. L. Nordine,** formerly with the maintenance of way, valuation and bridge and building sections of the Alton's engineering department, have been appointed specialized industrial sales district representatives for **R. G. LeTourneau, Inc.** Mr. Fey, with headquarters in Peoria, Ill., has been assigned to work with LeTourneau railroad distributors in Chicago, St. Louis, Mo., Kansas City, and Omaha, Neb. Mr. Nordine will work out of Philadelphia, Pa., and will contact railroad distributors there and in Pittsburgh, Pa., Baltimore, Md., and Columbia, S. C.

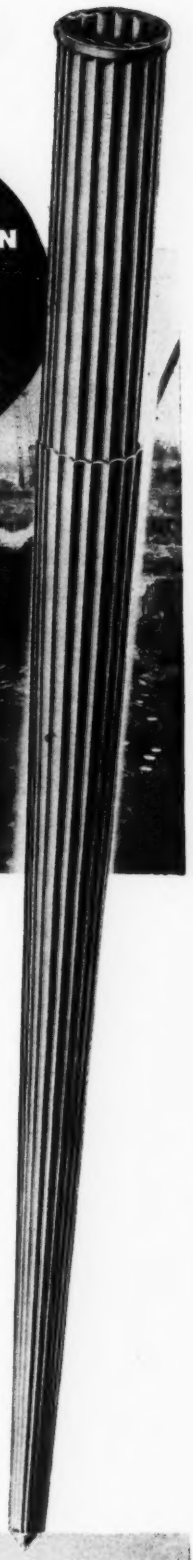
Obituary

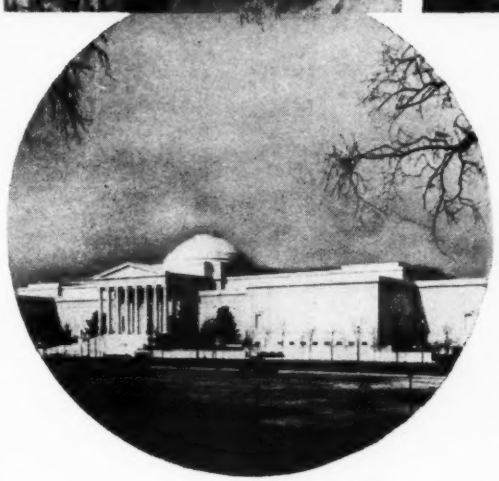
L. J. Papineau, vice-president of the Canadian Johns-Manville Company, Ltd., in charge of the transportation department, died April 3. He was 60 years of age, and had been associated with the firm since 1911.

Putting up a Big Job?

BE SURE THE FOUNDATION IS RIGHT— USE MONOTUBES







COST-CONSCIOUS, profit-wise engineers and contractors who have used Monotube *steel* foundation piles base their enthusiastic endorsement on past performance.

Here are some of their typical comments:

"Monotube's fluted, tapered design made driving easy . . . with standard equipment we had at hand."

"Monotube's easy extendibility, in the field, saved us time and extra labor costs."

"We like Monotube's speedy top-to-toe inspection feature. Their hollow, tubular construction lets us do a thorough job before we pour the concrete."

Why not turn Monotube's many advantages to your benefit on the next construction job? They're available in a gauge, size and taper to meet the requirements of varying soil conditions. For additional information and competent engineering assistance on jobs, large or small, write The Union Metal Mfg. Co., Canton 5, Ohio.

UNION METAL

Monotube Tapered Piles

Inside Information about WISCONSIN V-TYPE 4-CYLINDER ENGINES

A Cylinders for V-type engines are cast in pairs, separate from crankcase for easy servicing and economical replacement.

B Provision for mounting pump housing or generator housing directly on crankcase permits extremely compact installation.

C Camshaft is precision-ground on a special, automatic machine that assures absolute uniformity and quiet operation.

D Connecting rods are 2½ times the length of stroke and are accurately balanced to eliminate any weight variations in excess of ¼ oz., thus assuring a smooth-running engine.

E Extended shaft is part of crankshaft proper so pulley, sprocket or driving gear can be mounted on this extension without the need for outboard bearing or solid power take-off.

F Timken tapered roller bearings at both ends of the dynamically balanced drop-forged crankshaft take up end thrust and provide protection against bearing failure.

G Renewable valve seat inserts on both intake and exhaust simplify servicing, reduce replacement costs, provide true seating and long life.

H Pistons are made of highest quality aluminum alloy for light weight and high serviceability.

I Cylinders are honed to a mirror finish for perfect piston fit and smooth operation.

J Large capacity flywheel fan produces a sufficient volume of air to cool the engine in any temperature up to 140° F. Air blast is forced across and around the cylinders and heads.

K Crank-pins are mirror-finished on a special super-finishing machine as a further contribution to a smooth-running engine.

L Gear pump provides individual oil stream through oil jets to each connecting rod. Engine will not pump oil at any normal operating angle. All parts not served by gear pump are lubricated by oil spray. There isn't a single oil cup or grease fitting on any Wisconsin Engine.

These are features that contribute to the rugged, steady-going dependability and high operating efficiency of Wisconsin Air-Cooled Engines on all types of railway maintenance jobs, within a 2 to 30 hp. power range. Tell us about your requirements.

Most H.P. per pound

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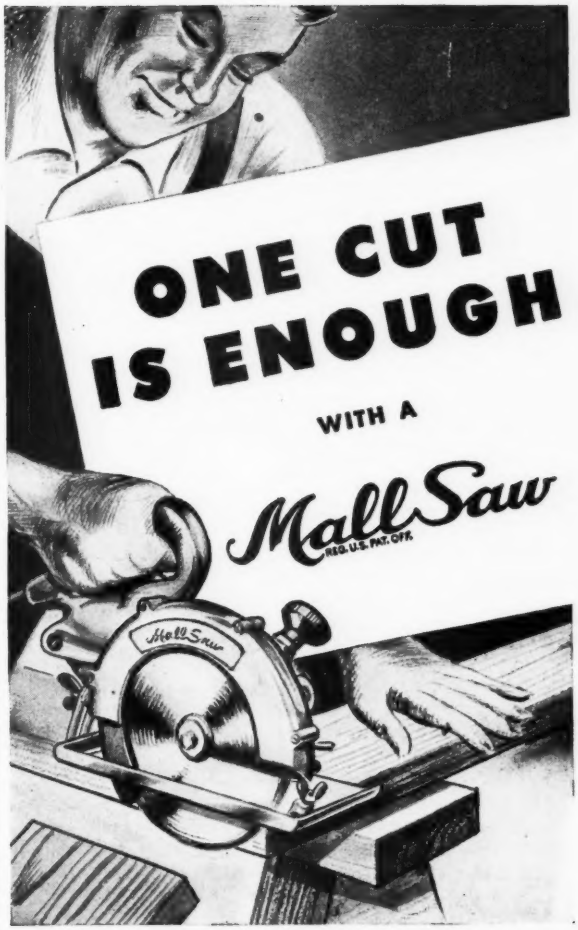

One stroke with a MallSaw cuts a board easily and smoothly . . . leaves a square board end . . . produces a better fitting member . . . saves hard-to-get lumber . . . facilitates multiple cutting of like members.

Each feature of the MallSaw is designed to maintain cutting speed. Perfect balance—with motor on long end of the board—makes a MallSaw easy to handle. A blower keeps the cutting line clear of sawdust. An automatic safety guard protects the worker.

Easy adjustment for depth and bevel cuts and interchangeable blades and abrasive discs make the MallSaw adaptable to a wide variety of sawing jobs, including cutting non-ferrous metals, cutting and scoring tile, stone, concrete, etc. Electric MallSaws are manufactured for 110-volt AC-DC or 220-volt AC-DC. There are also Pneumatic models.

Ask your supplier for MallDrills, MallSaws and Mall Chain Saws or write direct for literature and prices.

Railroad Department
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7746 South Chicago Avenue **Chicago 19, Illinois**
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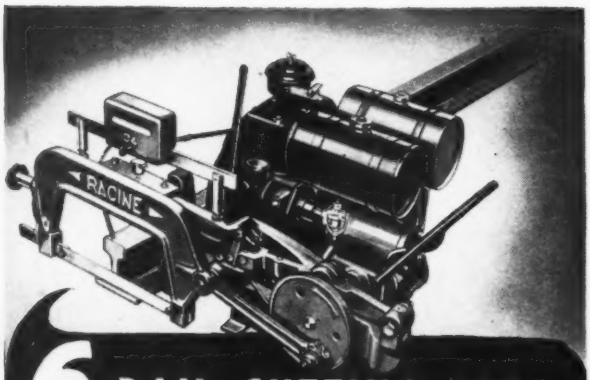

6 RAIL CUTTING JOBS made easier, quicker with RACINE *portable* Rail Saws

Now you can do your rail maintenance and repair jobs right on the track. No need for heavy "on track" equipment or extra hauling of rails to central cropping plant. Racine Rail Saws require only one man to operate. Two men can easily transport saw from rail to rail.

These fast, accurate machines, produce a smooth, clean-cut job without overheating rail ends. Model 15 for rails to 7⅜" high. Model 16 for rails to 10" high. Models are available with gas engines, compressed air or electric motors. Write for complete catalog No. 58A. Address RACINE TOOL AND MACHINE COMPANY, 1738 State Street, Racine, Wis.

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2. Closing track in rail laying operations.
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4. Proper staggering of joints in curves.
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Racine gas engine driven Rail Saws for immediate delivery.

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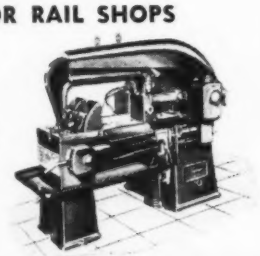
Racine Heavy Duty Metal Saws pay for themselves through their many time and labor saving features. Simple controls, smooth automatic hydraulic operation make them the ideal saws for rail shops for cutting axle shafts, boiler pipe, channels, angles and beams quickly and accurately. Capacities 6" x 6" to 20" x 20". Ask for complete descriptive catalog No. 12.



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We control every step of their manufacture — from the specification of the specially-developed formula and process used in making the steel to the forming, hardening, tempering and testing operations.

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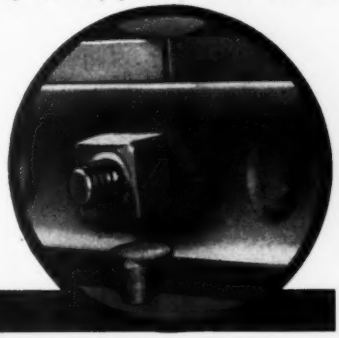

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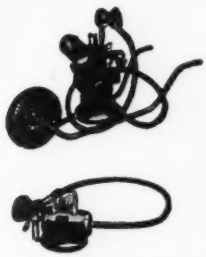

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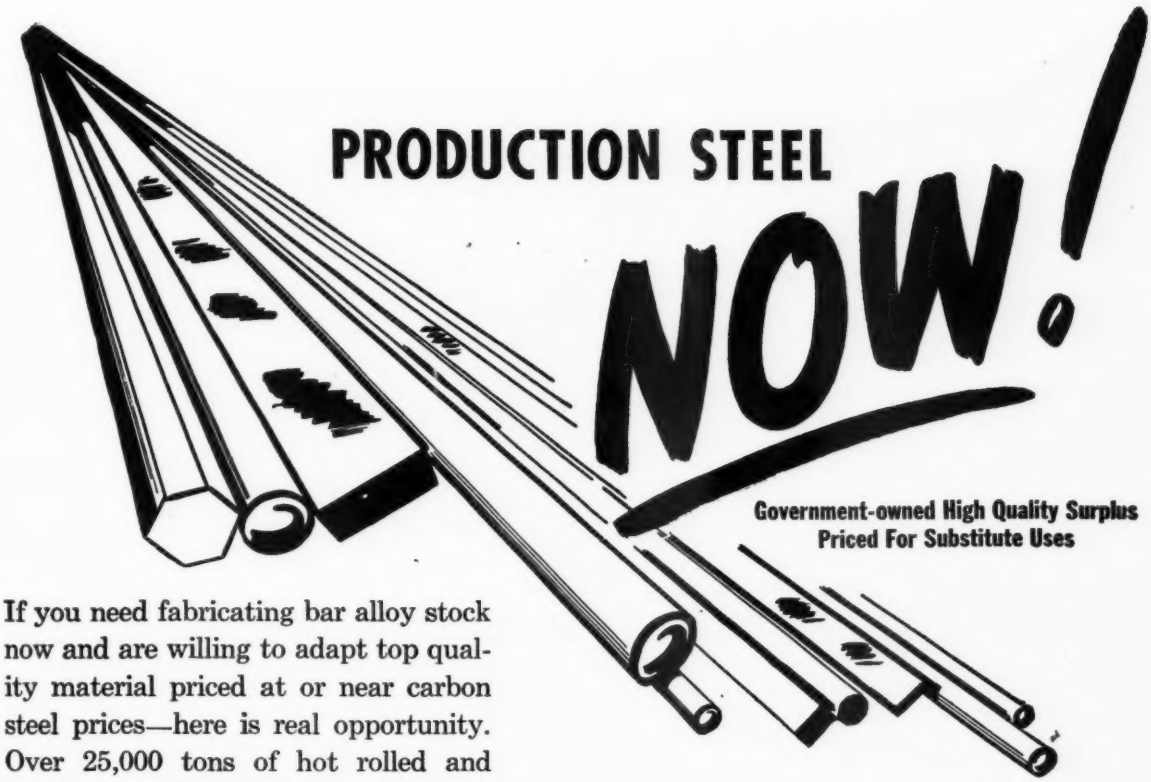

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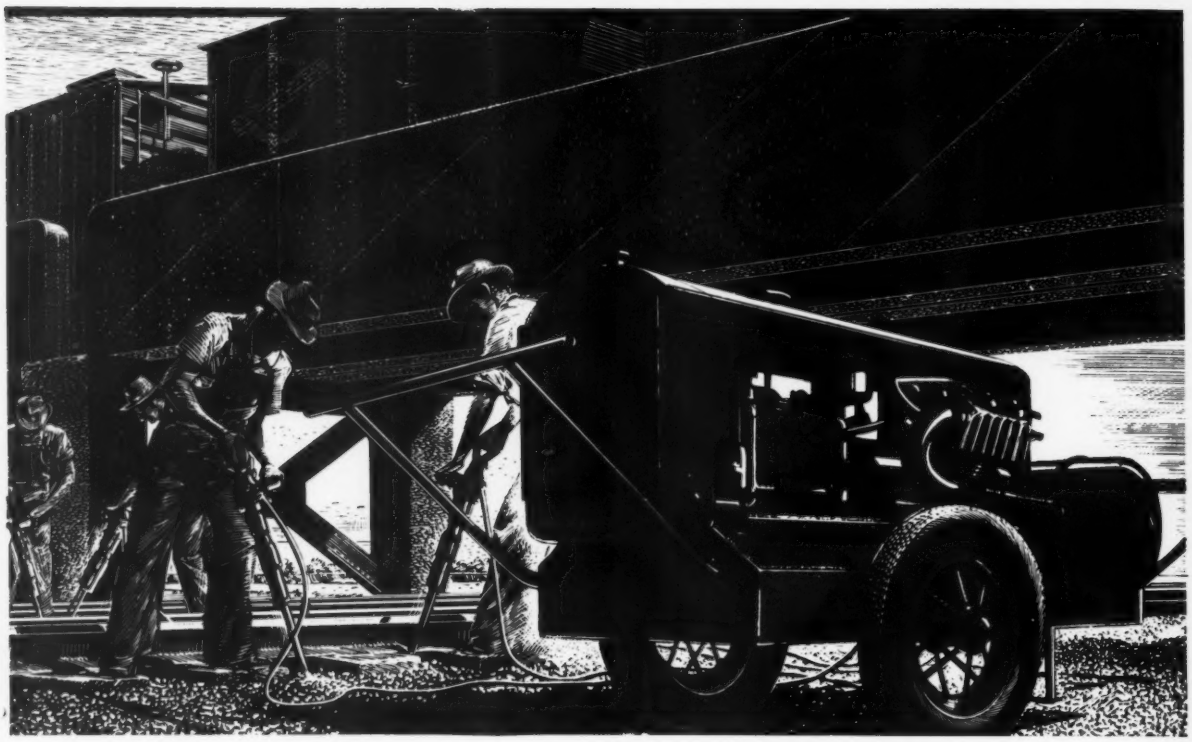
ALPHABETICAL INDEX TO ADVERTISERS, MAY, 1946

THIS SPEEDY TRACK TEAM KEEPS ITS BREATH



These fast runners don't get winded — and they make work easier for the men, too.

The Blue Brute Hand-I-Air Compressor has the easy-breathing Feather* Valve — lightest, tightest, most efficient ever made . . . handling 60 cu. ft. per min. without the slightest strain. The Hand-I-Air is compact, easily maneuverable, a cinch for two men to handle.

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Also working on the railroad these days are such other Blue Brute Track Teams as: portable Diesel and gasoline engine-driven compressors and rail-car compressors teamed up with rock drills, trench diggers, backfill tampers . . . all famous for making less air do more work.

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